SOME ASPECTS OF BILINGUALISM IN MALAYSIAN CHINESE

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ABSTRACT

Categorized and noncategorized Chinese and English words, appearing in unilingual and bilingually-mixed lists were presented in a continuous recognition task. Enunciation and translation errors and response times were recorded for twenty bilingual subjects. Categorization and translation had little effect on performance, but in bilingually-mixed lists recognition error rates differed for Chinese and English targets, suggesting that mode of graphic representation may be an important aspect of Chinese-English Bilingualism.

CHAPTER I

INTRODUCTION

The following quotation from Young (1971) prompted this author to carry out this study:

> ...that psycholinguistic findings need to be replicated cross-culturally before any conclusions on the universality of human language functions can be made.

In the field of bilingualism, researchers usually compare Indo-European languages. This study is an attempt to compare the linguistic cognitive representations of an Indo-European language and a Sino-Tibetan language. The Indo-European language used in this study is English and the Sino-Tibetan language is Chinese. Being exploratory in nature, this study does not claim to provide all the answers but it is hoped that with whatever findings that may eventuate, others may be persuaded or prompted to investigate particular findings in greater detail.

Throughout the literature, the meaning of the term "bilingualism" varies. Here, a broad definition is adopted. Bilingualism is defined as "the practice of alternatively using two languages" (Weinreich, 1953). Using this simplified definition the relevant literature will be reviewed. The hypotheses and experimental factors, and finally, a brief summary of the principles of Chinese characters will be discussed in this chapter.

1. INDEPENDENCE OR INTERDEPENDENCE MODEL?

In the field of bilingualism and cognition, there have been constant debates and investigations regarding the representation of languages in bilinguals. Two extreme views, referred to as the independence versus the interdependence models, (McCormack, 1974; 1977) or the separate versus the common storage models (Kolers, 1963) have been of major concern for investigators of bilingualism. The independence model postulates that in bilingualism, the two different languages are stored separately. The cognitive processing of one language is not automatically affected by the other. On the other hand, interdependence model holds that a unified semantic memory is common to both languages, that is, the languages all share the one common storage and are interlingually connected.

Kolers (1963) in his word-association study with three bilingual groups (that is, German, Spanish, and Thai bilinguals) found that the items were language-tagged and stored separately. The main results of the study was that only about one third of all responses exhibited commonness of representation. Kolers then argued that if verbally-defined past experiences were tagged and stored in a form specific to a given language, the bilinguals would find it difficult to retrieve them in another language. Hence, Kolers (1963) concluded that his data supported the independence model.

However, in a more recent study, Kolers and Gonzalez (1980) pointed out that the finding of the 1963 study does not really constitute a full support of the independence model. The proportion of all the responses

that characterised common representation was only one third. This proportion is too small to give support to the interdependence model but it is also too large to support the independence model.

Glanzer and Duarte (1971) conducted a free-recall study to investigate the effect of repetition between and within languages. The lists consisted of English and Spanish words. Each list contained words repeated in the same language (within-language repetition) or words followed by their translation equivalents (between-language repetition). They found that between-language repetition gave higher recall in a list than within-language repetition. This led the researchers to favour the independence model.

In another free-recall study, 25 Arabic-English bilinguals were used (Liepmann and Saegert, 1974). The subjects were divided into two groups. For one group, all the items presented were in one language (the unilingual-list group) while for the other group, items from both languages were randomly presented (the bilingual-list group). The results indicate that the two groups did relatively well. The researchers suggested that the subjects seemed to have stored the items for recall specifically in the language in which they had encountered, hence supporting the independence model.

Tulving and Colotla (1970) used English, French, and Spanish words in their research. The materials were given to the subjects at two different rates of presentation (that is, 0.5 sec. per word and 2 sec. per word). The data showed that the recall of words from primary memory was identical for unilingual and multilingual lists. However, the recall of words from secondary memory was superior for the unilingual lists;

next best was the bilingual lists; and the poorest recall came from the trilingual lists. Also, the recall of the words in the particular language producing the best recall for the unilingual lists was greatly impaired for the bilingual and trilingual lists. On the other hand, the recall of words in the language producing the least unilingual recall suffered relatively little impairment for the bilingual and trilingual lists. This was interpreted as showing that for the unilingual lists, a single language presumably encourages the formation of higher order organizational units in which each word can serve as a retrieval cue for another. Thus, the findings imply that the two languages of a bilingual, or the three languages of a trilingual exist in relative isolation from one another. These results, therefore, are consistent with the independence model.

The evidence for the independence model reviews some aspects of the role language plays in the organization of memory. For example, a noticeable amount of time is taken to switch from one language to another (Macnamara and Kushnir, 1971); relatively few words are misrecalled as to language from bilingually-mixed lists (Saegert, Hamayan, and Ahmar, 1975); and reaction time is slowed when translations are used in memory search tasks (Clifton, Sorce, Schaye, and Fiszman, 1978). In general then, research on the independence model although substantial, is less abundant than that of the interdependence model.

There is considerable evidence for the interdependence model. A few studies are discussed here, while the rest will be discussed at later stages in this chapter. The investigation of Lopez and Young (1974) used a "familiarization effect" method. The bilinguals had to first familiarize themselves with a list consisting of either Spanish or

English words. They then learned another list composed of words that were the same or different from those in the first list. The results showed that the same amount of positive transfer was obtained for both groups, therefore the familiarization effect was assumed to have been uniform for both intralingual and interlingual learning. Hence, the findings provide support for the interdependence model.

Another study whose results support the interdependence model is one done by Saegert, Kazarian and Young (1973). There were two experiments involved; one using English-Spanish bilinguals and another using Arabic-English bilinguals. The free-recall study was based on the part/whole transfer paradigm. That is, subjects learn a part list of 10 items and then a whole list of 20 items of which 10 are from the part, or first, list plus 10 new items. In the study by Saegert et al. (1973) the bilingual transfer group studied the part list consisting of all 10 items from one language and the whole list that was made up of 10 translation equivalents from the part list and 10 new items from the same language as the translation equivalents. Negative transfer was obtained when subjects learned the whole list in their nondominant language. The researchers reasoned that the results illustrated the interdependence of the languages. The organizational units in the dominant language are relatively easy to form and relatively difficult to modify whereas those in the nondominant language are relatively difficult to form and relatively easy to modify.

In a developmental study of decoding and encoding processes, Magiste (1979) made comparisons of Swedish and German monolinguals with bilingual and trilingual subjects. The decoding and encoding processes were expressed in terms of reaction time. The data indicated

that the multilinguals' reaction time to verbal stimuli was significantly slower than the monolinguals' reaction time. This is accounted for by the less-frequent usage of two or three languages compared with one, and the interference of the competing linguistic systems. Hence, the interdependence model is supported.

Other studies that provide evidence for the interdependence model include facilitation of serial learning by translation (Young and Saegert, 1966); interlingual interference in paired-associates learning (Kintsch and Kintsch, 1969); and the picture-word interference task (Ehri and Ryan, 1980).

Kolers and Gonzalez (1980, Experiment 2) set out to investigate precisely how interactive across languages the semantically related words are, in a free-recall study. Their rather ingenious investigation assumed that some Spanish words could be translated into single English words (for example, the Spanish words "barco" and "navio" are translated into the English word "ship") and were therefore synonymous. The aim was to investigate the likelihood of recalling any one of these Spanish words as opposed to some other words that were repeated in the list. The results indicate that multiple translations affect recall in the same way as exact repetition. But the exact repetitions facilitate recall more effectively than the synonyms (Kolers and Gonzalez, 1980, Experiment 1). Hence, it was deduced that facilitation within language is less than facilitation between languages. This supports the postulation of the independence model.

In general, effects that depend on language are taken to support the independence model whereas effects that are independent of languages are said to favour the interdependence model. However, some studies

obtained findings that are not as clear-cut as those reported above. Doubts that began to emerge as early as the late 60s, prompted rethinking in the field of cognition and bilingualism (Kolers, 1968).

Kintsch (1970) had his 19 bilingual subjects perform a continuous recognition task on English and German nouns. Group I identified both word-concepts and language-specific forms (that is, identified each item as either new, repeated in the same language, or repeated in the other language). Subjects in Group II identified language-specific forms (that is, responded "YES" only if item was repeated in the same language). The third group of subjects, Group III, identified word-concepts (that is, they responded "YES" even if the items were the translation equivalents). The results show that subjects can code words either on the basis of a language-specific or a semantic scheme. Also, the two types of schemes overlap, hence implying that subjects cannot completely disregard the other type of scheme while concentrating on a particular type of scheme.

Oksaar (1972, 1976) comes up with the suggestion that bilinguals do not have only two sets of languages, L_1 and L_2, but three, including L_3. L_3 contains elements and rules from L_1 and L_2 as well as elements and rules typical only for L_3. They are activated according to the requirements of the situation. The deduction of this is made from the observation method. Observations were made with bilinguals engaging in conversations in social settings. These observations involved both acquisition of bilingualism in children and bilingualism in adults.

In a more recent study, Kolers and Gonzalez (1980) proposed that when the experimental tasks involved lists of words, people encode them in as many ways as the time and task allow them to. Thus, the suggestion was that linguistic representations of bilinguals are independent or dependent, depending on the particular skills that are utilized in a given experimental task.

2. LANGUAGE OR SEMANTIC SCHEME?

As mentioned before, investigators tend to link language-dependent and language-independent effects with independence and interdependence models. The language-dependent effect is primarily considered to be the language scheme whereas the language-independent effect is the semantic scheme. Language scheme simply means that the cognitive storage of the word items is organized on the basis of the languages. Likewise, semantic scheme refers to the cognitive storage of the word items organized on the basis of the semantic content. Hence, it is not surprising to find that language and semantic schemes are the issues of concern in numerous studies. One method of investigating these schemes is by categorization, that is, to investigate whether subjects store information by their language or by some kind of semantic scheme. The general framework of many studies is to investigate whether categorization facilitates memory recall. If so, attempts are made to find out which scheme provides the most powerful organizational unit.

Goggin and Wickens (1971) conducted a study using the Brown-Peterson paradigm. There were three experimental groups and one control group. Four words were presented in each of the four tests. The words in the first three tests were all from the same taxonomic category and in the same language. The experimental group received a change in material in Test 4: there is either a change in language; a change in category; or a change in both language and category. The type of material remained the same in Test 4 for the control group. Spanish (S) and English (E) languages were used. The category of foodstuffs (F) and the category of body parts (B) were also used in the experiment. Subjects were to say aloud the four words presented. Then they were asked to do a Stroop test (a rehearsal-preventing activity) for 18 sec. After that length of time had

elapsed, subjects were given 8 sec. to recall the four words. Equal number of subjects were assigned to each of the four possible language and category combinations: EF, EB, SF, and SB. Release from proactive interference resulted when either language or taxonomic category of the items was changed. In the single shift condition, when language was changed (and not the taxonomic category), there was almost complete recovery from proactive interference. This led the authors to conclude "that although the Spanish and English words were nominally from the same category, the categories in the two languages may be psychologically distinct".

Another study similar to those mentioned in Section 1 (Kolers, 1963; Tulving and Colotla, 1970) is one in which a range of pictorial and verbal encoding modalities was examined (Tversky, 1974). Reaction time was used to measure a same-different task of Hebrew-English bilinguals. The results showed that knowing that the second stimulus would probably be a word did not speed comparison time to a second word as opposed to a picture. Also, reaction time to second expected verbal stimuli was virtually identical to the reaction time to unexpected verbal stimuli, as well as to unexpected pictorial stimuli. Hence, mental representations of words seem to be language-specific.

There are also studies demonstrating that the semantic category is the main organizational unit for processing linguistic information. The study by Caramazza and Brones (1980) is one recent investigation supporting the semantic scheme. The experimental task involved subjects having to determine in a speeded categorization task whether a particular presented item was a member of a previously specified category. The items were both Spanish and English words. The results showed that bilinguals possess semantic memory. The researchers reasoned that

categorization times do not differ in the same-language versus mixed-language conditions since the network structure that contains information from the two languages favours the interdependence model.

Many other studies also demonstrate the semantic scheme as the primary organizational unit in the memory. For example, subjects found that the semantic properties of test-words provided more important cues than did the language of the test-words (Segalowitz and Lambert, 1969) and, translations and items semantically consistent with those presented earlier were frequently accepted as identical, although not as often as items actually seen previously (Rosenberg and Simon, 1977).

Studies that illustrate that both the semantic and the language schemes play a role in the organization of information processing are not uncommon. Dalrymple-Alford and Aamiry (1969) interpreted their findings as providing support for the view that the bilingual's free-recall is structured mainly in terms of language-category clusters. Hence, this reflects stronger intralingual/intracategory associations rather than simply intralingual or intracategory associations.

Taylor's investigation (1971) using word fluency task, indicates that intra-language associative links are on the average stronger than inter-language links. Also, there exist some links across languages between semantically related words. However, links across two languages between semantically related words are not as strong as intra-language links. The word association patterns of bilinguals seem to be similar in the two languages, even when their relative skills in the two languages are not equal.

Barnett (1977) investigated the semantic organization of French-English bilinguals, applying multidimensional scaling to a series of direct paired-comparisons among a group of concepts from both languages. The concept terms dealt with the mass media (for example, newspaper, magazines, etc.). The findings support the hypothesis that both language and semantic content operate as organizing mechanisms. However, there appeared to be only one semantic system for information processing. The language scheme seems to be no more than a secondary determinant of the single system.

Twenty English-speaking monolinguals and 20 French-American bilinguals were used to carry out a study (Russ, Gold and Cherulnik, 1975) in order to obtain certain coding measures: latency, reaction time, number of words, number of syllables, and interpersonal agreement; and to obtain an indication of "meaning intensity". Words that had intense meaning for bilinguals may be those that elicit a host of association. For bilinguals, the results showed that meaning intensity was directly related to the coding measures.

3. UNILINGUAL VERSUS LINGUISTICALLY-MIXED LISTS

A common experimental paradigm in testing the bilingual's information processing is to use memory tasks on different types of word lists. It seems that the different types of lists (that is, unilingual and linguistically-mixed lists) presented to bilinguals can affect memory recall. However, most studies demonstrate that linguistically-mixed lists are recalled as well as unilingual lists.

Kolers (1965) presented subjects with long lists of words. On some lists, the words appeared in red or in black colour; on the other lists,

they appeared in French or in English words (the unilingual lists). In mixed lists, the words appeared both in red and in black; or both in French and in English words. The data showed that subjects recalled as many words from the mixed language set as from the unilingual set.

A between-subject experiment was carried out by Liepmann and Saegert (1974) whereby one group of subjects were presented with unilingual lists and the other group was presented with mixed-language lists. Again, recall of mixed lists was no different from recall of comparable unilingual lists.

Dalton (1973) also reported that in his study, English-Spanish bilingual subjects recalled mixed lists just as efficiently as they did with unilingual lists. In the whole/part paradigm research of Saegert, Obermeyer and Kazarian (1973), no difference was observed in whole-list learning between unilingual and bilingually-mixed lists.

However, when words can be grouped into semantic categories, recall is much better than when there are no obvious category possibilities (Lambert, Ignatow, and Krauthamer, 1968; Nott and Lambert, 1968). Nott and Lambert (1968) found no difference in free-recall between unilingual and mixed lists with non-category lists. However, with category lists, recall from mixed lists was poorer than unilingual lists and the researchers attributed the difference to the greater amount of information that must be retained about each item in a mixed list. Also, the recall of non-category lists was not as sensitive an index of the degree of bilingualism as was recall of category lists. With category lists, both recall and category clustering occurred less in the nondominant language.

A rather exceptional finding emerged in a study by Tulving and Colotla (1970) where the highest recall was from the unilingual lists, the second highest recall was from the bilingual lists, and the poorest recall was from the trilingual lists.

McCormack and Novell (1975) investigated further into the exceptional findings by Tulving and Colotla (1970). Three groups of 20 French-dominant subjects were used. The languages of the 18-word unilingual and trilingual lists were French, English and Spanish. The data showed that two of the three groups exhibited equivalent recall from the unilingual and the trilingual lists from the secondary memory. From the primary memory, all three groups had superior recall from the unilingual lists. For the trilingual list recall, dominant-language items were superior in primary memory but inferior in secondary memory. These results are consistent with the previous studies (Nott and Lambert, 1968; Tulving and Colotla, 1970) which reported that dominant-language items have rehearsal priority in primary memory.

McCormack, Brown and Ginis (1979) conducted a study where Greek-English and French-English subjects were postcued to recall items from one language or from both languages. The usual phenomenon of superior recall of nondominant-language items in secondary memory was not evidenced. It was concluded that subjects gave rehearsal priority in nondominant-language items when they were set to recall from both languages.

4. TRANSLATION AND TRANSLATION EQUIVALENTS

Translation is a special language skill and obviously not a primary skill since monolinguals get along perfectly well without it. There is no correlation between translation speed and the degree of bilingual proficiency (Lambert, Havelka and Gardner, 1959). It seems that in order to gain proficiency at translation skills, they have to be learned and practised. However, spontaneous use of translation by bilingual subjects has been reported.

Clifton et al. (1978) tested Spanish-English bilinguals for the speed with which they performed a recognition task. Their results showed a translation effect in searching memory for words presented in one language. Translation effect reflects the "encoding and rehearsal processes that occur before the probe is presented". Reaction time was increased when translations were used in memory search tasks. The researchers concluded that subjects stored words in a language-specific form. This may account for the rare interlingual confusions in short-term memory tasks (Kolers, 1966; Kintsch and Kintsch, 1969; Glanzer and Duarte, 1971; Goggins and Wickens, 1971; Rose and Carroll, 1974). While this may certainly be the case at the level of single words, the evidence indicates that this remarkable accuracy breaks down somewhat at the level of sentences (Macnamara and Kushnir, 1971).

Evers (1970) demonstrated that presentation of a "translated" and a "nontranslated" series supports interlingual facilitation. However, this facilitation may operate in an unbalanced direction (Lopez and Young, 1974). Segalowitz and Lambert (1969) found that translation equivalents were quickly incorporated in reaction time tasks or judgements as to semantic categorization. However, subjects are unable to regard the translation equivalents of previously learned words as new words totally (Kintsch, 1970).

Language switching in paragraph-length material takes time (Macnamara and Kushnir, 1971). Subjects took an appreciable amount of time to pass from one language to another. The effect of increasing the number of switches (that is, 1, 2 or 3 switches) was roughly additive. It seemed that attempting to anticipate a switch in input slowed the subjects down. It was as though they tried to alert both language systems at once and ended up by making their tasks more difficult.

In a study by Tversky (1974), words equivalent in meaning but in different languages (that is, the words and their translation equivalents) were investigated. The findings failed to support a single semantic modality for the two linguistic representations. Thus, there is no evidence that words automatically and immediately arouse their translation equivalents or that words make direct rapid contact with a semantic system.

However, as mentioned earlier, subjects do frequently accept translation equivalents and items semantically consistent with previously presented items as identical. The same pattern of results can be found when items are in sentences, or when they are pictures and sentences; regardless of the language, the type of test sentence, or the nature of the language of the subjects (Rosenberg and Simon, 1977). Hence, the status of the translation equivalents is not unlike that of synonyms within the same language, the degree of synonymity being greater when items have concrete referents (Dalrymple-Alford and Aamiry, 1970).

While some studies may suggest that semantically related words are similar to those of translation equivalents, other researchers suggest that translation equivalents are not retained in the memory as synonyms. Instead, translation equivalents and words share the same supralinguistic language-free semantic representation in memory (Liepmann and Saegert, 1974; Saegert, Hamayan, and Ahmar, 1975).

Kolers and Gonzalez (1980) compared interlingual and intralingual synonyms with exact repetition of words. Interlingual synonyms (translations) were found to have identical effects to those of exact repetition whereas the intralingual synonyms showed less recall than exact repetitions. The researchers concluded that bilingual equivalence of words is due to the tasks demanded. It also seems likely that bilinguals translate only in the initial stages of becoming bilinguals or when they encounter some particular difficulties, and that they are less likely to translate from their nondominant language to their dominant language.

5. HYPOTHESES AND EXPERIMENTAL FACTORS

McCormack (1974) reviewed five studies which are of relevance to the topic of independence and interdependence models. He concluded that the evidence seemed to point to the direction of the independence model. However, three years later McCormack (1977) wrote another review with another five studies and the conclusion was that these studies provided support for the interdependence model. These two reviews exhibit a good indication of the confusing and conflicting stage of bilingualism theory. To date, this independence-interdependence controversy is still very much alive. Judging from the evidence of the literature, it does seem that depending on the researcher's interpretation on his/her findings, one or the other model may be adopted. This leaves the author to suggest that perhaps all the studies have been testing different aspects of bilingualism. In the experimental setting, bilinguals encode as much information as the time and task allow them to (Kolers and Gonzalez, 1980). So depending on the degree of utilization of decoding in a given task, the bilingual's linguistic representations may be independent or interdependent.

Albert and Obler (1978) views that in the field of bilingualism, most investigations make use of languages sharing a number of cognate words and an orthographic representation (for example, English, French, etc.) The findings may be more susceptible to mutual linguistic interference than languages with fewer similar features (for example, English and Japanese). Should this notion of mutual linguistic interference exist, this view would be observed by comparing an Indo-European language and a Sino-Tibetan language. Chinese is one of the most widely spoken languages globally; it is important therefore that it should

feature in bilingualism research, particularly as much of the bilingualism research to date has concentrated solely on Indo-European languages. Hence, this study was conducted to compare between an Indo-European language and a Sino-Tibetan language; with the Indo-European language being the English language and the Sino-Tibetan language being the Chinese language.

Nott and Lambert (1968) and Lambert et al (1968) found that categorized lists are always recalled better than noncategorized lists. If this is a universal phenomenon across languages, then the same finding can be replicated using diverse languages. Also, if categorization does facilitate recall, then categorization may speed up recognition performance. Tweedy and Lapinski (1981) point out that "semantic context is a relatively automatic phenomenon resulting from the previous processing of a stimulus which happens to be related in meaning to the words being recognised". It is therefore proposed in this study to investigate whether categorization facilitates recognition performance and whether categorization decreases response time.

Numerous studies have shown that equivalent recalls are obtained from unilingual and linguistically-mixed lists (Nott and Lambert, 1968; Dalton, 1973; Liepmann and Saegert, 1974). Also, if translation is just a language skill, then having to translate presented items, should not affect the subjects' recognition performances. However, translation can affect the time subjects take to respond. Thus, the second proposal is to test whether equivalent recognition performance can be obtained from different types of lists and whether translation has any affect on response time.

The findings of Kolers and Gonzalez (1980) show that interlingual synonyms (translations) have identical recall effect to exact repetitions. However, intralingual synonyms have different recall effect as exact repetitions. Therefore, it can be deduced that interlingual synonyms have different recall effect as intralingual synonyms. If this is true, then the time taken to respond to translation equivalents will be longer than the target or the buffer selection (see Chapter III, Section 5 for their definitions), provided that the subjects recognise the translation equivalents as "new" stimuli. This is because when a translation equivalent is presented, the semantic scheme may be activated (that is, the semantic context has been perceived before) and the subject has to decide in which language s/he had seen the semantic context represented. This would take longer to decide than it takes to decide whether an obvious target or buffer selection had been seen. Here it is proposed to investigate whether translation equivalent selection takes a longer response time than does target or buffer selection for both languages.

The final proposal is to investigate whether there is any difference in forgetting an item for English words as compared to Chinese characters. It is noted that the graphic representation of Chinese and English languages is different. English language uses the alphabetical representation in its writing and is 86 per cent phonetic (Kline and Lee, 1972). Chinese language makes use of ideographic representation in writing in which each symbol or character represents a morpheme. Tong (1971) advocates "that Chinese writing is a crystallization of concretism, a concretism which symbolizes the most abstract ideas in human knowledge".

Hypothesis Number One: That categorization will facilitate recognition performance and will decrease response time as compared to noncategorization.

Hypothesis Number Two: That equivalent recognition performance will be obtained from unilingual and bilingually-mixed lists under both enunciation and translation condition, and that under translation condition, the response time of the recognition task will be much longer than the response time under enunciation condition.

Hypothesis Number Three: That false target selection will take longer to respond to than is the case for target or buffer selection.

Hypothesis Number Four: That there may be differences between the number of Chinese items and the number of English items recognized in a bilingually-mixed list.

These hypotheses will be tested by utilizing the recognition performance and response time of the items presented. Since the subjects will be responding to the stimuli verbally, verbal responses made by the subjects will be considered.

Three main factors were under investigation in this study. The first factor is Enunciation/Translation. As the author was interested in investigating the effect (if any) translation has on recognition performance and response time, it was decided that enunciation should also be used. Enunciation and translation will ensure that subjects actually perceive the stimuli presented.

Noncategorization/Categorization is the second main factor of the study. With the "categorized" feature of the Chinese writing (see Chapter I, Section 6) and the mental semantic categorization, Chinese linguistic representation may be "double-categorized". However, this is not the case for English words. Hence, it will be interesting to investigate the Noncategorization/Categorization factor on Chinese characters and English words. Also, no study has measured the effect categorization or noncategorization has in terms of response time.

Finally the last main experimental factor is List Type. Nott and Lambert (1968) found that noncategory lists and category lists had different effects on recall. The difference in opinion on recall from different types of lists (Nott and Lambert, 1968; Tulving and Colotla, 1970; Liepmann and Saegert, 1974) shows that this issue is still to be resolved. Also,the time taken to respond to the items from different types of lists may provide further insight to the cognitive organization of bilingualism.

6. PRINCIPLES OF CHINESE WRITING SYSTEM

In the Chinese writing system, there are six principles (六書) of Chinese characters (Wieger, 1965; Tong, 1971). They are namely the imitative drafts (像形), the logical aggregates (會意), the phonetic complexes (形声), the indicative symbols (指事), the extended meaning (轉注), and the false borrowing (假借). The first four concern the symbolization of characters while the last two refer to the improper but accepted usage of some characters. Hence, only the first four are discussed. Of the four principles, the first three are called the "static" principles and the fourth one is the "dynamic" principle, according to the absence or presence of movement in the process of symbol formation.

The imitative drafts are rough sketches representing the objects. These are pictograms. While many of the symbols may be modified or replaced, their contents and meanings continue to be unaltered. The following are some examples of the modern and older forms of pictographs.

		Modern forms	Older forms
(1)	face	面	
(2)	mouth	口	
(3)	fish	魚	
(4)	bow	弓	
(5)	sun	日	
(6)	moon	月	

The logical aggregates are made up of two or more simple characters which are the synthetic logical products of the constituents. Strictly speaking, the characters thus formed are ideograms. For example,

(1) bright : sun + moon

i.e. 明 : 日 + 月

(2) male : strength + field

i.e. 男 : 力 + 田

The third "static" principle is the phonetic complex. It consists of two or more simple characters. One of them indicates the meaning and the other the pronunciation. Some examples of the phonetic complexes are as follows:

(1) copper : metal + phonetic elements

i.e. 銅 : 金 + 同

(2) cat : feline + phonetic element

i.e. 貓 : 豸 + 苗

The fourth principle is "dynamic" in character because there are actions or gesticular movements in the character-forming processes, hence the name indicative symbols. Some examples are as follows:

(1)  (servant) : a man standing presents something

(2)  (to walk) : two feet towards the same direction in the middle of a cross road

(3)  (to follow) : one man walks behind another

(4) (to flee) : two men, back-to-back, in front of a street entrance.

(5) (interior) : to penetrate into the interior of a defined space

CHAPTER II

METHOD

In order to examine the various aspects of bilingualism, a recognition task was conducted. The experiment was carried out in the Computer Laboratory of the Psychology Department, University of Canterbury.

Three independent judges were initially involved in the selection of the stimuli.[1] They were all Malaysians of Chinese origin. Two of them were university students while the third one was a homemaker. All three judges resided in New Zealand for at least three years and they used both the English and the Chinese languages regularly in their daily activities.

From a large sample of words, the experimenter selected the stimuli under the advice of two of the judges. Then the selected word pool was presented to the third judge under experimental condition.[2] After the experiment, the third judge and the experimenter re-assessed the stimuli and replaced any stimuli that might be difficult for subjects to respond to.

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[1] The term "stimuli" refers to the English words and the Chinese characters that were used in the experiment.

[2] This was necessary because the experimenter wanted to ensure that the stimuli selected were elementary and common in daily usage.

1. SUBJECTS

There were 20 subjects used in this experiment, of which four were females and 16 were males. They were overseas Malaysian students studying in the University of Canterbury. The subjects were selected with the condition that they were able to read elementary Chinese characters and English words. They were in the age group of 21-27 years. The native language of all the subjects was the Chinese language. In addition, all of the subjects had spent at least seven years in educational institutions in which English was the medium of instruction. Hence, all of the subjects were fluent in both languages.

2. MATERIALS

(1) Reading Passages

There were two sets of reading passages (Appendix A). One set consisted of two short Chinese passages[3] (China Reconstructs, 1959a; 1959b) and the other, two short English passages (Quek, 1965; Radin, 1972). All four passages had been read by the three independent judges described above. They mutually agreed that the two sets of passages were of about equal length and similar standard.

For each subject in the experiment, a stop-watch was used to measure the time taken to read each of the two sets. The order of the two sets was presented randomly. The purpose of these passages was to establish the fluency with which each subject read both English and Chinese prose.

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[3]Two short passages were used instead of one long passage because the experimenter could not find any long, yet elementary Chinese passage.

(2) Questionnaire

A questionnaire was constructed dealing with the general linguistic background of the subjects (Appendix B). In addition to the general questions asked, the subjects self-rated their fluency of writing, reading, listening to, and speaking the Chinese and the English languages, along a seven-point scale. Half of the subjects were randomly assigned to answer the questionnaires written in Chinese while the rest were given questionnaires written in English. The questionnaire was used to obtain additional information on the fluency of the subjects in both languages. This information was required to ascertain whether or not fluency as such was a factor relating to their performance on the experimental task.

(3) Stimuli

The words used were taken from various sources (Paivio, Yuille and Madigan, 1968; Jeng, Lai and Lui, 1973; Chen, 1974). The stimuli were selected such that they could be easily and unambiguously translated, and in the case of the English words, their translation equivalents were generally single Chinese characters. The three independent judges checked through the stimuli to ensure that the stimuli were words with common daily usage and that, where required, the translation equivalents were not difficult to produce verbally. The word pool from the above sources consisted of 480 Chinese and English stimuli of which about three-fifths were nouns, one-fifth adjectives, and the rest verbs (Appendix C). The stimuli in each list were randomly arranged in each list and were hand-written in a single column on "fanfold" computer paper.

(4) Design

A 2 x 2 x 3 factorial design with repeated measures on all three factors were used. There were two blocks of lists: one consisting of related words (i.e. the categorized words) and the other, the unrelated or the noncategorized words. Each block was subdivided into three types of lists - the unilingual lists in Chinese, U_C; the unilingual lists in English, U_E; and the bilingually-mixed lists in both languages, B_M.[4] Each block was also divided into two experimental conditions - the enunciation condition and the translation condition (see Figure 2-1). In the enunciation condition, subjects read aloud at the time of presentation what they perceived whereas in the translation condition, they uttered the translation equivalents of what they perceived.

(5) Apparatus

A PDP 11/10 computer was used to run the experiment. Two terminals were used; the subject sat at an LA-30 Decwriter, the experimenter controlled the computer from a VT-50 video screen. In effect, the Decwriter was used as a computer-driven memory drum. Line-feeds (generated by the computer program) advanced the lists the required amount, to present stimuli at a cardboard aperture described below. Pushbutton responses made by the subjects were recorded by the computer and used to initiate line-feeds to the next item on the list, or to the start of a new list.

A movable response unit (30 x 14.2 x 4.2cm) was positioned horizontally in front of the subject (see Appendix D). There were five

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[4]The unilingual lists consisted of lists of words containing only one language - either Chinese or English. The bilingually-mixed lists had equal numbers of Chinese and English words randomly mixed throughout the list (see Appendix C).

pushbuttons mounted on the unit. Behind the unit was a piece of cardboard with a narrow aperture of 5 x 1.7cm. It was through this aperture that the stimuli were presented singly (Appendix D). A softwave timer inside the computer was used to record the subject's response time for each individual stimulus. The computer also recorded which particular push-button the subject had pressed on each trial.

Two computer programs were written for the running of the experiment (Appendix E). One was used to run the experiment at the time of gathering data and to store the subjects' responses on digital cassettes. The other program was used to retrieve the data from the digital cassettes for subsequent analysis.

(6) Lists

Each list consisted of 60 stimuli in two separate phases. There were 20 stimuli in the study phase and 40 stimuli in the test phase. In the test phase, 20 of the stimuli were actual items from the study phase preceding it. These were called the target stimuli. The remaining 20 were placed in the list as distractor stimuli.[5] No stimulus occurred in more than one list in the experiment. In the case of the bilingually-mixed list, B_M, there were equal numbers of stimuli from both languages. That is, in the study phase, ten stimuli were from the Chinese language and the remaining ten from the English language. All of these target stimuli were presented in the test phase. The 20 distractor stimuli consisted of ten translation equivalents of the target stimuli and ten other stimuli. Of the ten translation equivalents or false targets, five were the translated items

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[5]Distractor stimuli are stimuli that appear in the test phase but not in the study phase.

of the Chinese target stimuli. Hence, they were English words. The remaining five translation equivalents or false targets were from the English target stimuli. Of the ten remaining distractor stimuli (i.e. buffer stimuli), half of them were in the Chinese language and the other half were in the English language (Figure 2-1, sample). The arrangement of the stimuli in the bilingually-mixed list was such that no more than three items from the same language would be sequentially presented.

In the block consisting of categorized words, there were five categories in every list. Three of these categories were "noun" categories, one was an "adjective" category, and the remaining one was a "verb" category. In the test phase of the categorized list, there were eight stimuli per category (that is, four target stimuli from the study phase and four distractor stimuli from the same category) See Figure 2-1, sample. For the noncategorized list, the stimuli were randomly selected with approximately the same numbers of nouns, adjectives and verbs in each list as in the categorized list.

There were two practice lists: one was used in the enunciation condition and the other was used in the translation condition. Each practice list consisted of four items in the study phase and a matching list of seven items in the test phase. (That is, the test phase included the four items from the study phase plus three distractor items.)

At the beginning of every list, the word "READY" could be seen through the aperture. The stimuli were then presented singly in a column down the page such that only one word at a time was visible through the aperture (see Appendix D). A buzzer then sounded on both terminals to

mark the end of the study phase. The beginning of the test phase was then automatically advanced by the computer, to position the list with the word "READY" showing through the aperture. The end of the test phase, and that particular list, was marked by the word "END" appearing at the aperture.

	Noncategorization			Categorization		
	U_C	U_E	B_M	U_C	U_E	B_M
Enunciation						
Translation						See Sample Below

Figure 2-1. Diagram of the overall experiment

Sample of a categorized, bilingually-mixed list.

Study phase:

1. 肺 - C_1
2. look - C_2
3. ginger - C_3
4. 高 - C_4
5. pig - C_5
6. old - C_4
7. garlic - C_3
8. 嗅 - C_2

9. brain - C_1
10. 肝 - C_1
11. 羊 - C_5
12. 輕 - C_4
13. elephant - C_5
14. heart - C_1
15. 瓜 - C_3
16. small - C_4
17. 嚐 - C_2
18. 鼠 - C_5
19. listen - C_2
20. 豆 - C_3

Test phase:

1. 高 (T, C_4)
2. dog (B, C_5)
3. 牯 (B, C_4)
4. 老 (FT-6, C_4)
5. liver (FT-10, C_1)
6. 芽 (B, C_3)
7. bean (FT-20, C_3)
8. kidney (B, C_1)
9. 心 (FT-14, C_1)
10. 薑 (FT-3, C_3)
11. 矮 (B, C_2)
12. meet (B, C_4)
13. 肺 (T, C_1)
14. onion (B, C_3)
15. small (T, C_4)

16. old	(T, C_4)
17. 豆	(T, C_3)
18. light	(FT-12, C_4)
19. elephant	(T, C_5)
20. 肝	(T, C_1)
21. ginger	(T, C_3)
22. 豬	(FT-5, C_5)
23. 兔	(B, C_5)
24. rat	(FT-18, C_5)
25. 瓜	(T, C_3)
26. 羊	(T, C_5)
27. 聽	(FT-19, C_2)
28. look	(T, C_2)
29. 輕	(T, C_4)
30. heart	(T, C_1)
31. heavy	(B, C_2)
32. garlic	(T, C_3)
33. 鼠	(T, C_5)
34. 嚐	(T, C_2)
35. brain	(T, C_1)
36. 嗅	(T, C_2)
37. pig	(T, C_5)
38. listen	(T, C_2)
39. 胃	(B, C_1)
40. smell	(FT-8, C_2)

Key: T : target stimulus

B : buffer stimulus

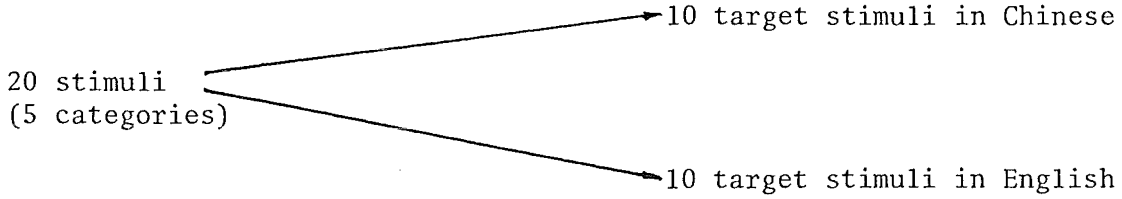
FT-α : false target stimulus, translation equivalent of target stimulus No. α.

C_β : category β, where β = 1, 2,..., 5.

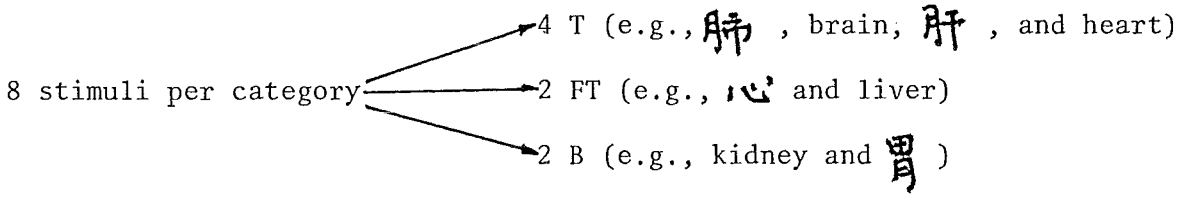
Study phase:

4 target stimuli (T) per category, e.g. 肺 , brain, 肝 , and heart.

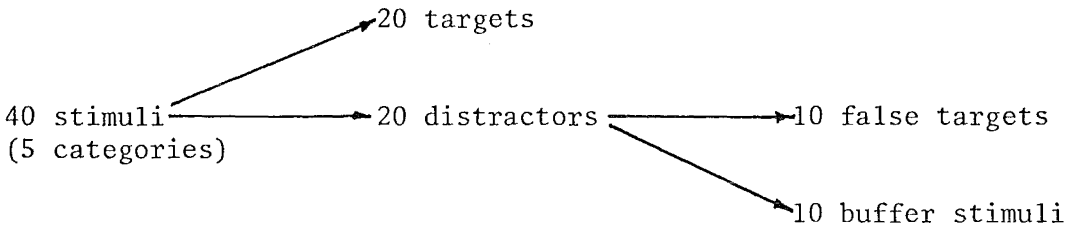
In total,



Test phase:



In total,



There were equal numbers of both Chinese and English items.

3. PROCEDURE

The experiment was conducted individually for each subject. The subject was first given a questionnaire to answer (Appendix B). After that, the subjects were given the instructions that referred to the way in which they were to respond to the reading passages. The reading time of the subject was measured separately for the two sets of the reading passages.

If the subject was given a questionnaire written in the English language, then the experimental instruction would be one written in the Chinese language, and vice versa. This is to ensure that the experimental situation is not language-specific. After reading the experimental instruction, the experimenter orally briefed the subject about the procedure to ensure that the subject fully comprehended the task involved. The two practice lists were then presented to the subject.

The computer was programmed in such a way that as soon as the subject pressed the "START" button, the first stimulus would be presented, and the timer would be started. The subject vocalised accordingly, and then pressed the "RESPONSE" button. The timer stopped and the second item in the list was presented and the timer started again. The computer recorded which particular button had been pressed and the time taken to respond to the stimulus. During the test phase of the list, the subject had to decide whether the stimulus was an item seen before, in which case, s/he pressed the "OLD" button. If the stimulus had not been presented before, then the "NEW" button would be pressed (Appendix F).

The subject was told to respond as quickly and as accurately as possible. In the case of the translation condition, the subject was encouraged to verbally produce the first translation equivalent of the stimulus that came to mind. It was also stressed to the subject that for the test phase, the "OLD" button should be pressed, *if and only if*, the item was presented in the target stimulus' original language. An "X" button was also provided for cases in which the subject was unable to enunciate or translate particular stimulus: this was the "DO NOT KNOW"

button. The experimenter informed the subject at the beginning of every list what experimental condition was forthcoming, whether the stimuli in the list were related, and whether the list was U_C, U_E, or B_M. The experimenter checked the correctness of the subject's verbal responses during the entire experiment. In the few cases where words were mis-perceived or incorrectly translated, the experimenter recorded the incorrect responses.

All twelve of the experimental lists were presented in one session for every subject. The experimenter often questioned the subject at the end of the list or at the end of the experiment to clarify what was intended by the subject in his/her verbal responses. At the end of the session, the experimenter told the subject about the general purpose of the experiment and answered any question the subject might ask to satisfy his/her curiosity.

CHAPTER III

RESULTS

The first part of this chapter deals with the statistical analyses of the responses of the experiment. The discussion of the statistical analyses explores the response outcomes in the light of the hypotheses mentioned.

The latter part of this chapter is concerned with the subjects' verbal responses. The verbal responses involved both ideographic and alphabetic symbols so they will not be analysed. They are presented because they indicate some interesting trends in the data. The errors made by the subjects are discussed, particularly where the subjects produced verbal responses that were different from that of the experimenter or where the subjects misperceived the stimuli.

1. FREQUENCY POLYGONS

Frequency polygons of the self-rating data were plotted to ascertain the shapes of the distributions of speaking, reading, listening to, and writing in the Chinese and the English languages (Figures 3-1 to 3-4). As can be seen, the distributions tend to be negatively skewed in cases dealing with the Chinese language while the cases dealing with the English language are more symmetrical. Subjects rated themselves as above average in speaking, reading and listening to the Chinese

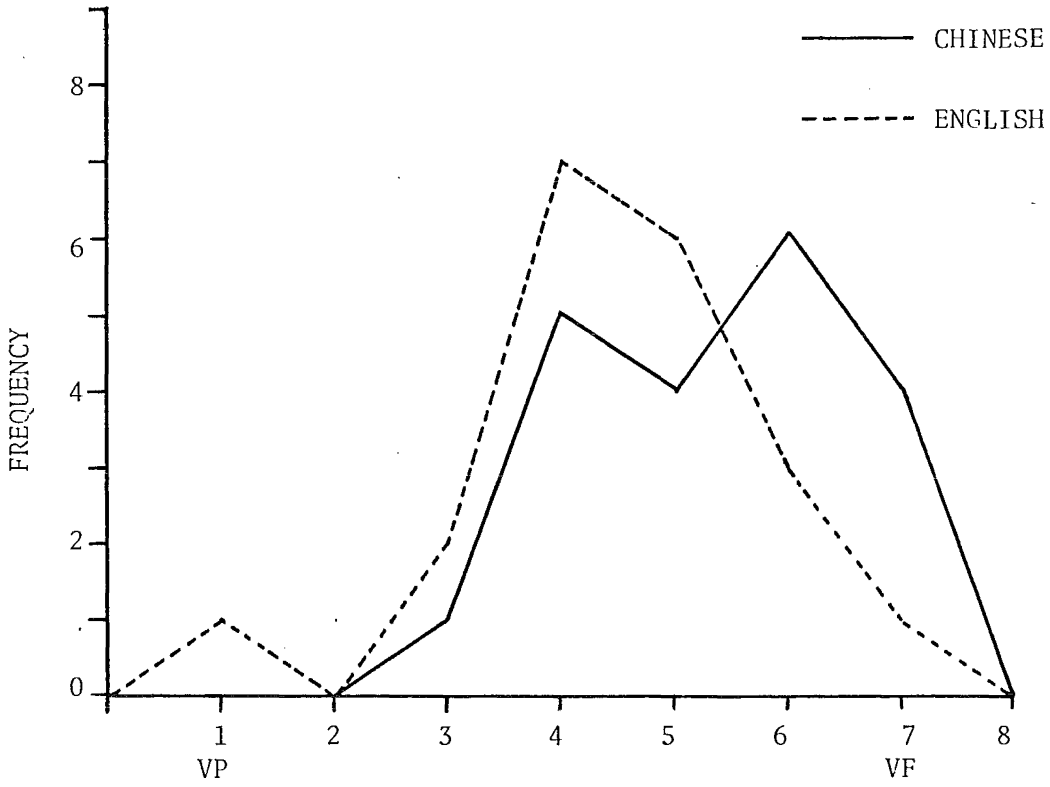


Figure 3-1. Self-ratings in speaking the languages

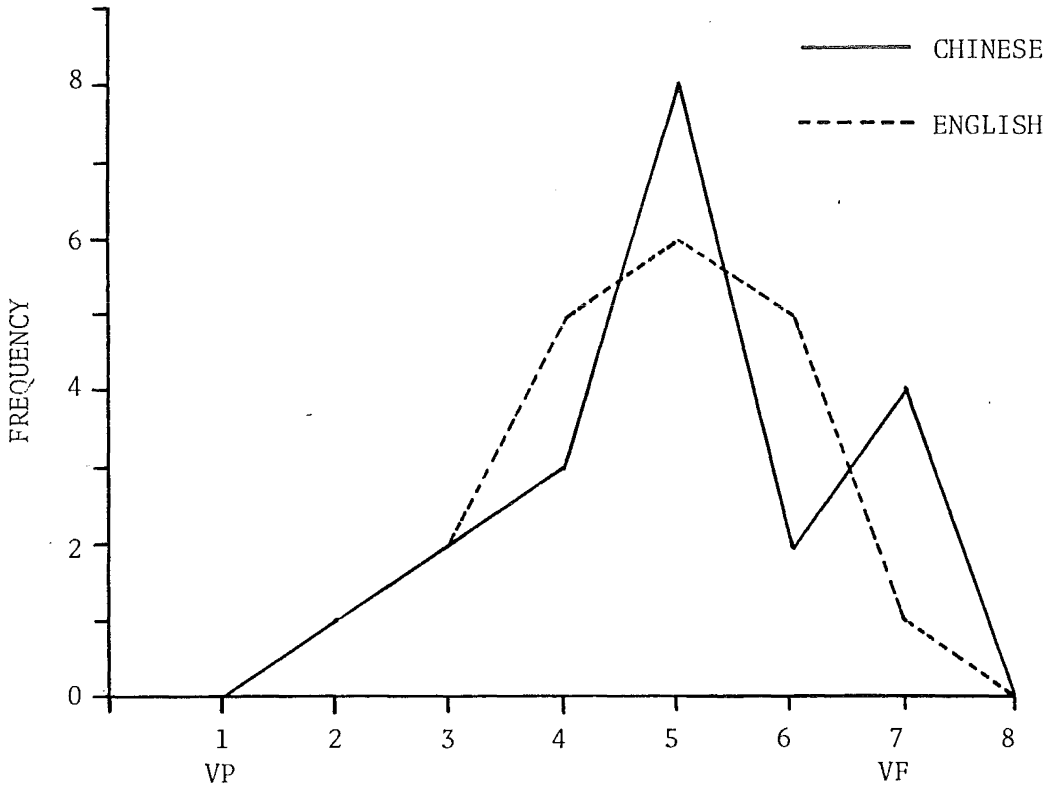


Figure 3-2. Self-ratings in reading the languages

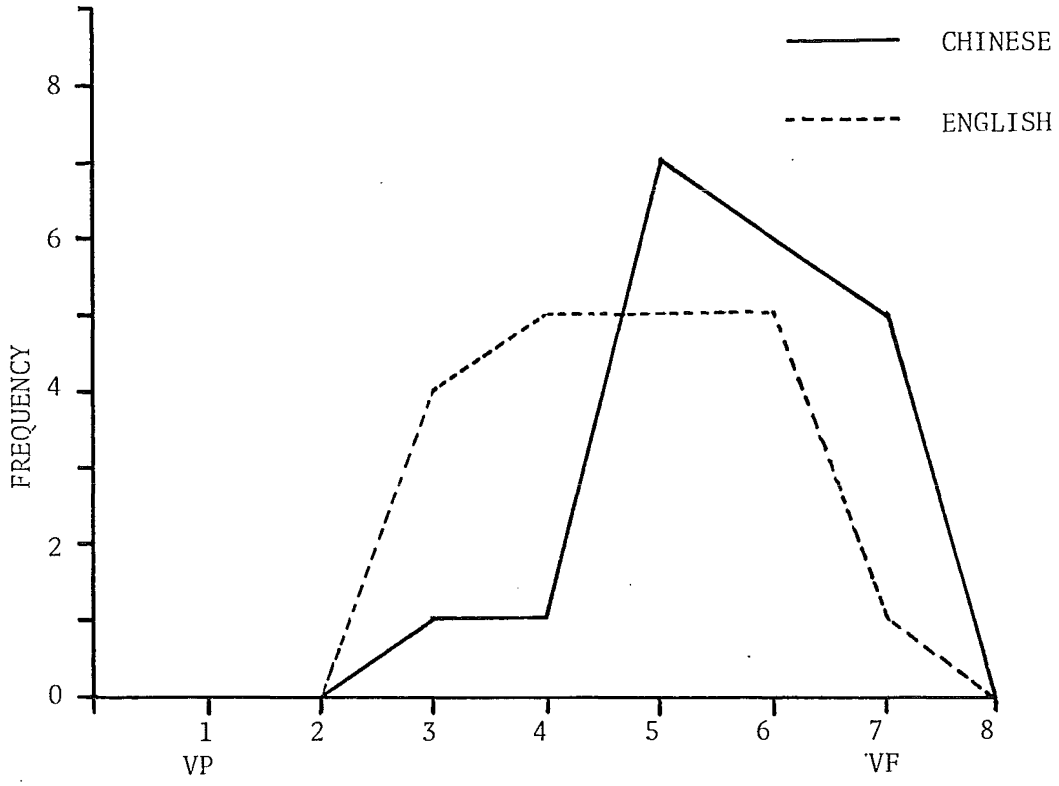


Figure 3-3. Self-ratings in listening to the languages

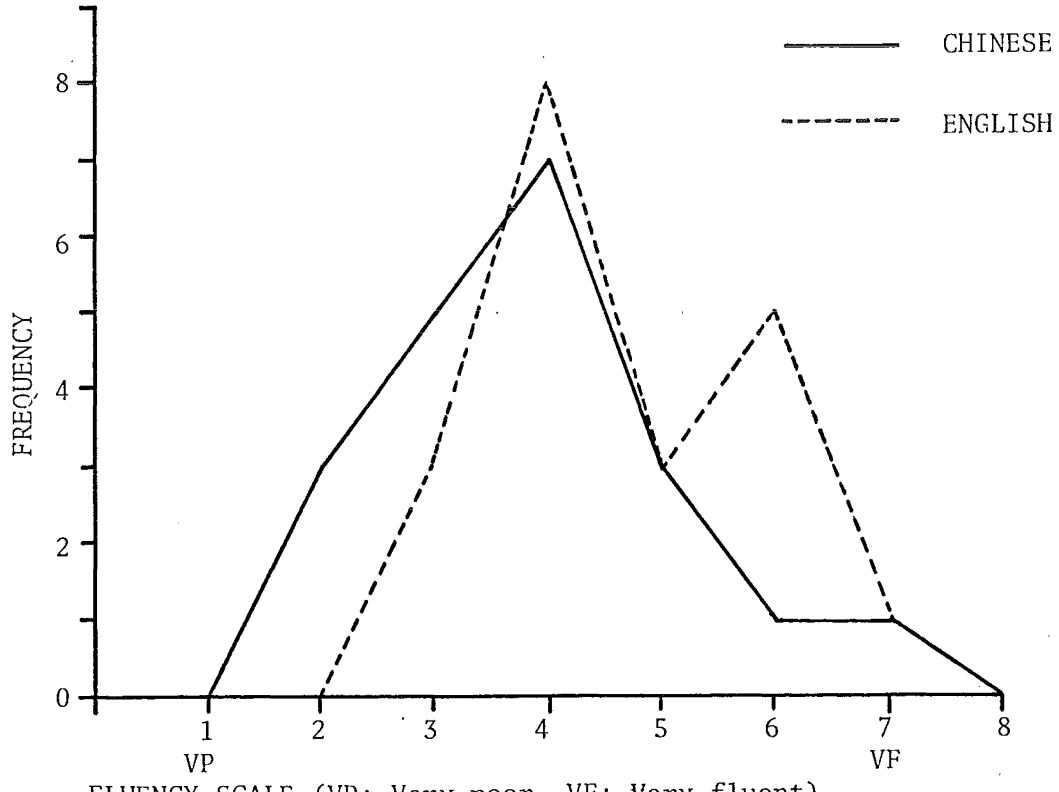


Figure 3-4. Self-ratings in writing the language

language; and as average in dealing with the English language (Figures 3-1 to 3-3). However, they saw themselves as average when it came to writing in both Chinese and English languages (Figure 3-4). This point will be further considered in Chapter IV.

2. REGRESSION ANALYSES

Simple linear regression analyses were used to establish the relationship between the time taken to read both the Chinese and the English passages and the self-ratings of the subjects. The relationship is called the regression function and the best possible straight line is then fitted through the points. The value of F is then calculated. This F statistic is a measure of the goodness-of-fit of the line.

These analyses verified that there was a significant linear relationship between the reading time and the self ratings of the subjects. The linear regressions were found to be significant (Table 3-1).

Table 3-1. Regression Analyses

	Intercept	Slope	r_{xy}	df	F	p
Reading time for Chinese passages Self-ratings of the Chinese language	138.78	-2.24	-0.41	1,18	9.96	<.01
Reading time for English passages Self-ratings of the English language	154.67	-1.95	-0.52	1,18	6.41	<.05

3. RECOGNITION PERFORMANCE

The recognition data was obtained by taking the number of items the subjects correctly recognised within each list.

A three way analysis of variance with repeated measure on all three factors were performed. The three factors were Enunciation/Translation (2 levels), Noncategorization/Categorization (2 levels), and List Type (3 levels). For the significant interactions of any two factors as a result of the analysis of variance, independent t-tests would be calculated. The means of the interactions are presented in graphs. The standard deviations are presented in the t-tables.

Table 3-2. ANOVA summary for recognition performance

Source	SS	df	MS	F	p
A	11.27	1,19	11.27	2.59	> .05 NS
B	2.82	1,19	2.82	1.61	> .05 NS
C	27.10	2,38	13.55	10.57	< .01
AB	16.02	1,19	16.02	10.87	< .01
AC	21.23	2,38	10.62	2.86	> .05 NS
BC	18.23	2,38	9.12	5.48	< .01
ABC	3.03	2,38	1.52	0.50	> .05 NS

Key: Factor A : Enunciation/Translation
Factor B : Noncategorization/Categorization
Factor C : List Type

The effect of the List Type factor was significant at the .01 level, indicating that there was a List Type difference in the recognition performance. The interaction between the Enunciation/Translation factor and

the Noncategorization/Categorization factor, and the interaction between the Noncategorization/Categorization factor and the List Type factor were both significant (Table 3-2).

Table 3-3. t-Tests for recognition performance over Enunciation/Translation x Noncategorization/Categorization Interaction

Enunciation:

Noncategorization	Categorization
$\bar{x}$ = 17.63	$\bar{x}$ = 17.93
S.D. = 1.77	S.D. = 2.03

t = 1.16

p > .05 NS

Translation:

Noncategorization	Categorization
$\bar{x}$ = 18.58	$\bar{x}$ = 17.85
S.D. = 1.98	S.D. = 1.83

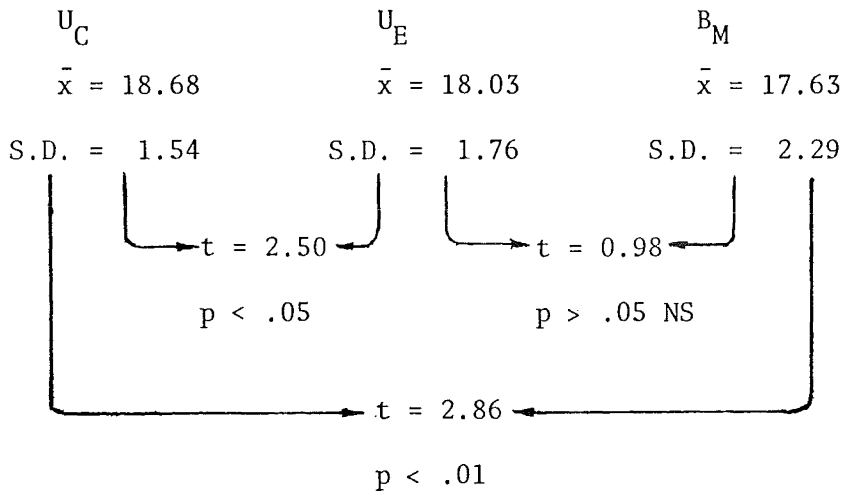
t = 2.60

p < .05

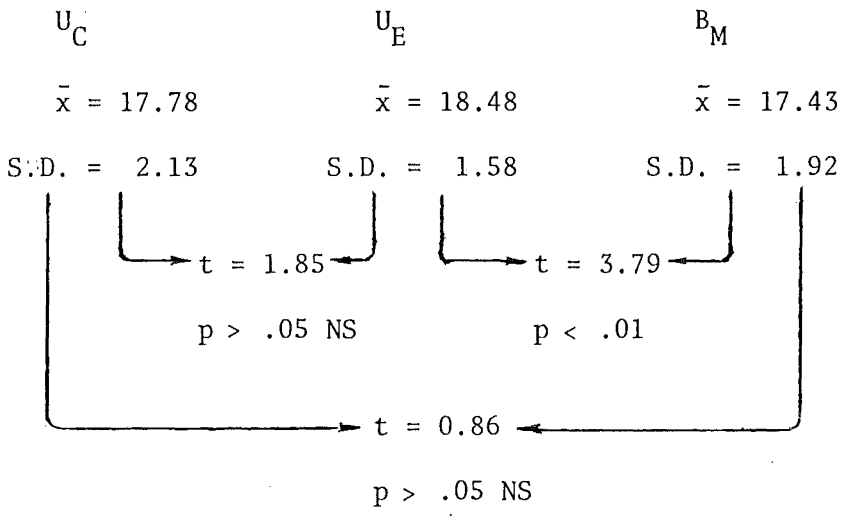
The t-test is only significant at the .05 level on the Noncategorization/Categorization factor under the translation condition (Table 3-3).

Table 3-4. t-Test for recognition performance over Noncategorization/ Categorization x List Type Interaction

Noncategorization:



Categorization:



For the noncategorized words the t-tests are all significant except those in the English unilingual list, U_E, and the bilingually-mixed list, B_M, comparison. But for the categorized words, the only t-test that is significant are those words in the U_E and the B_M lists comparison (Table 3-4).

The interaction graphs are presented in Figures 3-5 and 3-6. It can be seen that on the whole, the subjects had a high rate of recognition.

4. RESPONSE TIME

The response time taken to react for the various items was analysed in a three way analysis of variance with repeated measure on all three factors. The factors were Enunciation/Translation, Noncategorization/Categorization, and List Type. The mean response time refers to the time taken to respond to an item.

Table 3-5. ANOVA summary for response time

Source	SS	df	MS	F	p
A	57.38	1,19	57.38	70.98	< .01
B	3.12	1,19	3.12	24.10	< .01
C	3.02	2,38	1.51	10.11	< .01
AB	1.78	1,19	1.78	11.55	< .01
AC	4.43	2,38	2.21	5.22	< .01
BC	1.79	2,38	0.89	6.27	< .01
ABC	0.39	2,38	0.20	2.37	> .05 NS

Key: Factor A : Enunciation/Translation
Factor B : Noncategorization/Categorization
Factor C : List Type

The effect of the Enunciation/Translation factor was significant at the .01 level, indicating that there was a difference in the response time between the enunciation condition and the translation condition. The

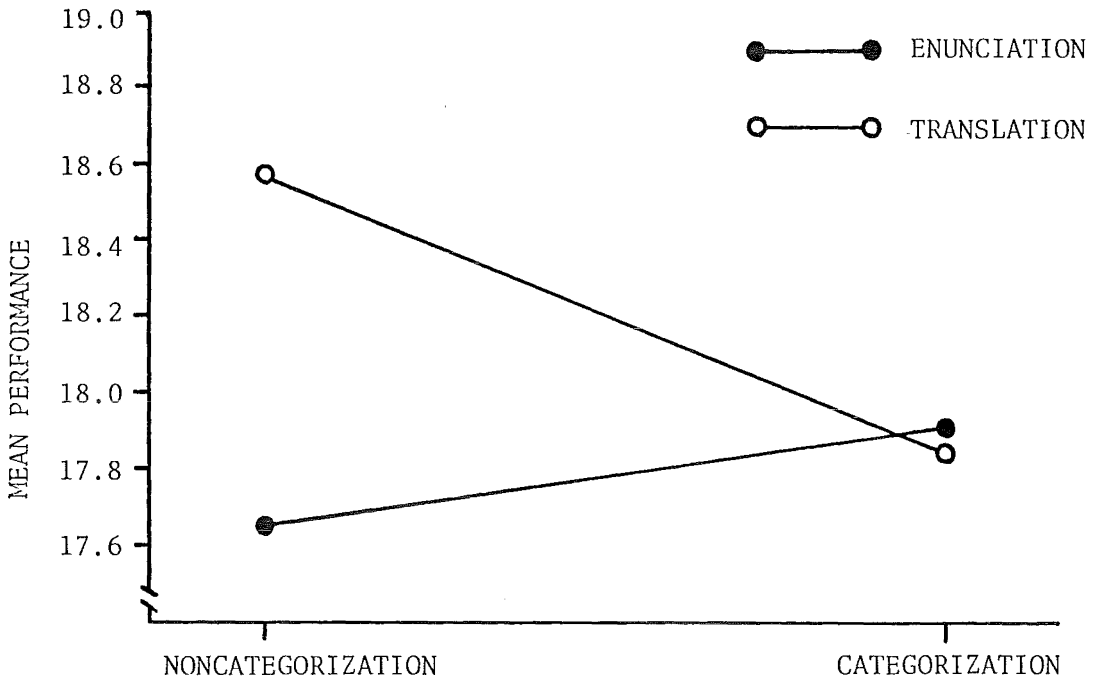


Figure 3-5. Mean recognition performance over Enunciation/Translation x Noncategorization/Categorization interaction

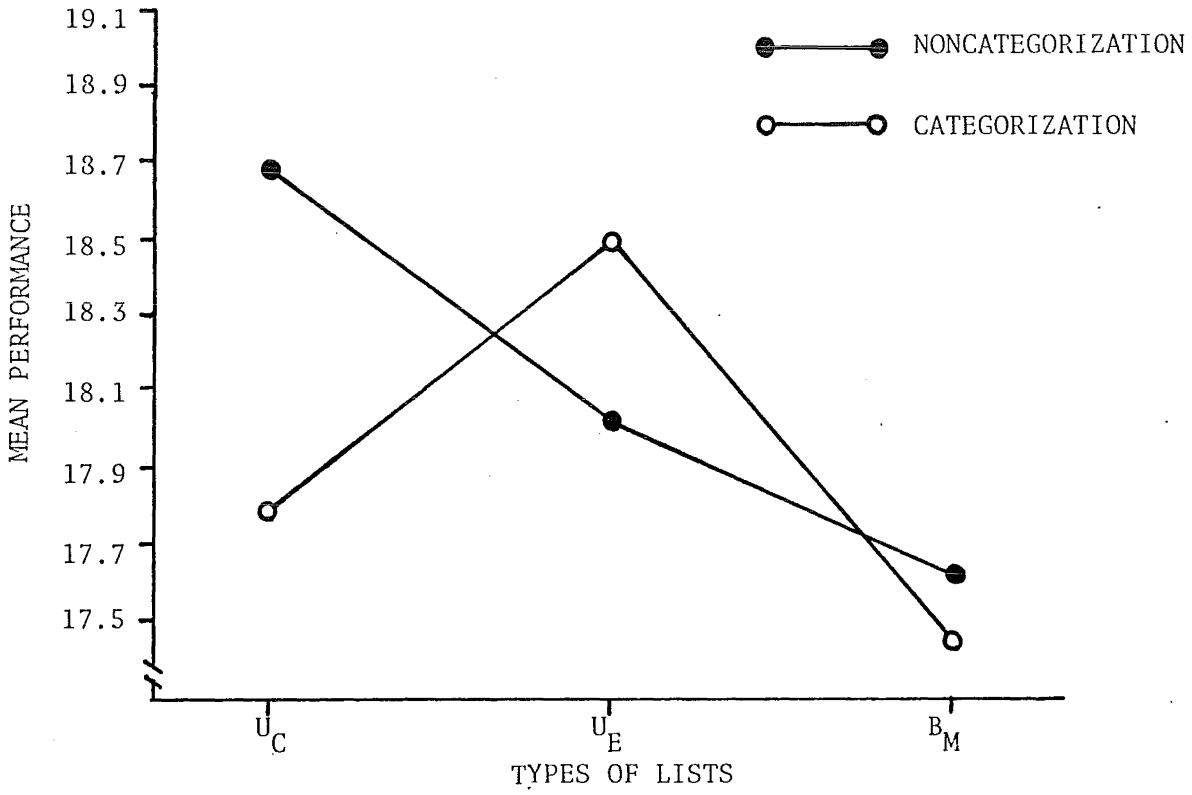


Figure 3-6. Mean recognition performance over Noncategorization/ Categorization x List Type interaction.

effect of the Noncategorization/Categorization factor was also significant at the .01 level. This indicated that there was a difference in the response time between categorized and noncategorized words. The effect of the List Type factor was significant at the .01 level, indicating that there was a difference in response time between the lists. All of the two way interactions were significant at the .01 level (Table 3-5).

Table 3-6. t-Tests for response time over Enunciation/Translation x Noncategorization/Categorization Interaction

Enunciation:

Noncategorization	Categorization
$\bar{x}$ = 1.50	$\bar{x}$ = 1.55
S.D. = 0.54	S.D. = 0.58

t = 1.34

p > .05 NS

Translation:

Noncategorization	Categorization
$\bar{x}$ = 2.30	$\bar{x}$ = 2.70
S.D. = 0.85	S.D. = 1.11

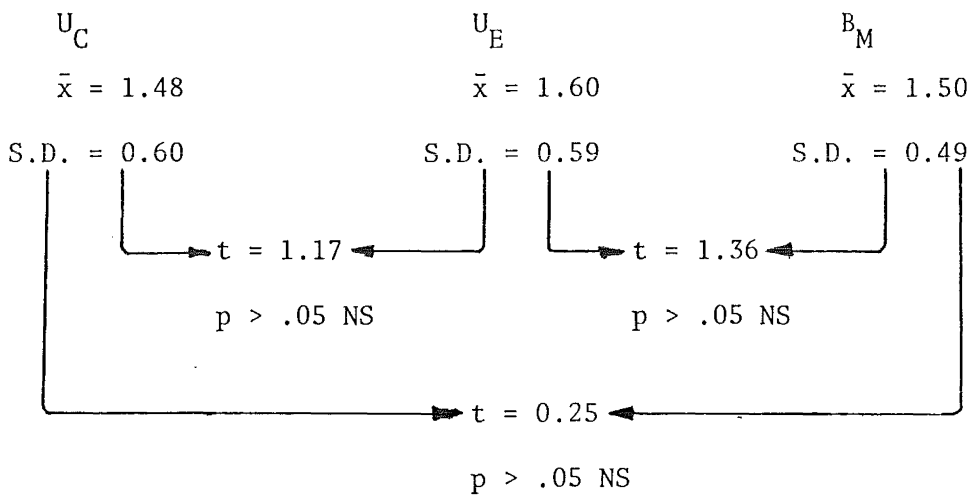
t = 4.87

p < .01

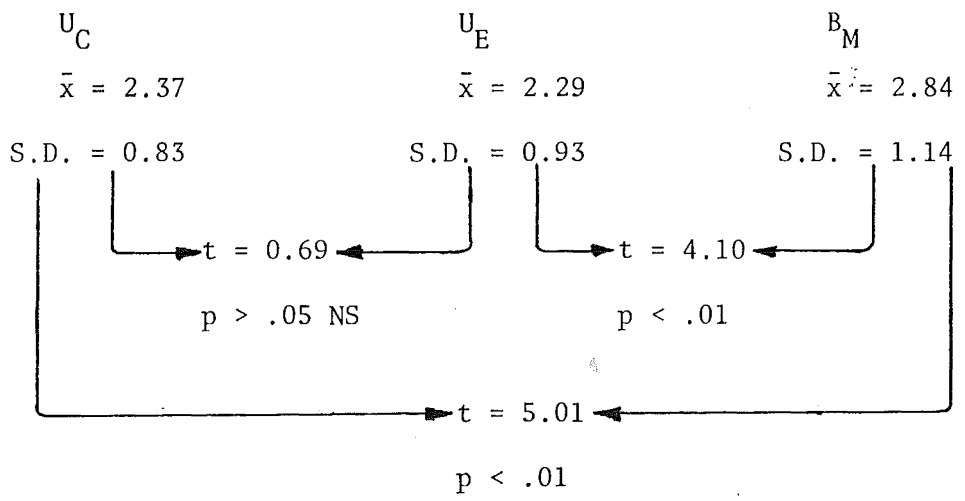
The t-test is significant at the .01 level, supporting that there is a Noncategorization/Categorization difference under the translation condition (Table 3-6).

Table 3-7. t-Test for response time over Enunciation/Translation x List Type Interaction

Enunciation



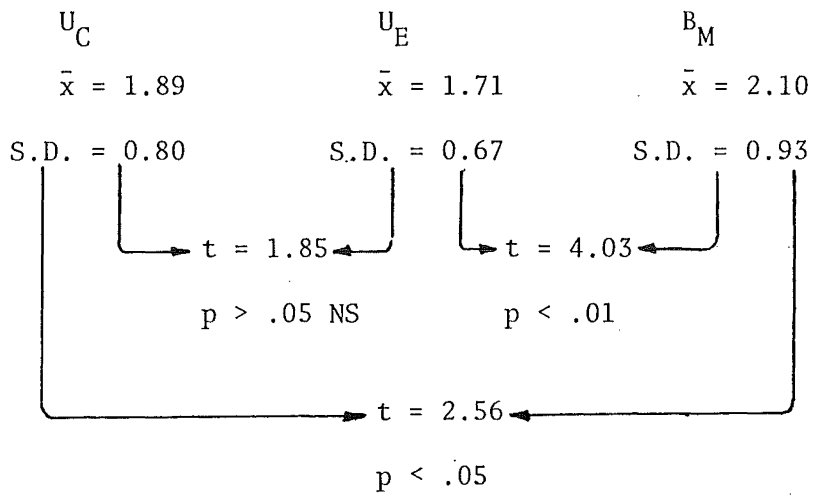
Translation:



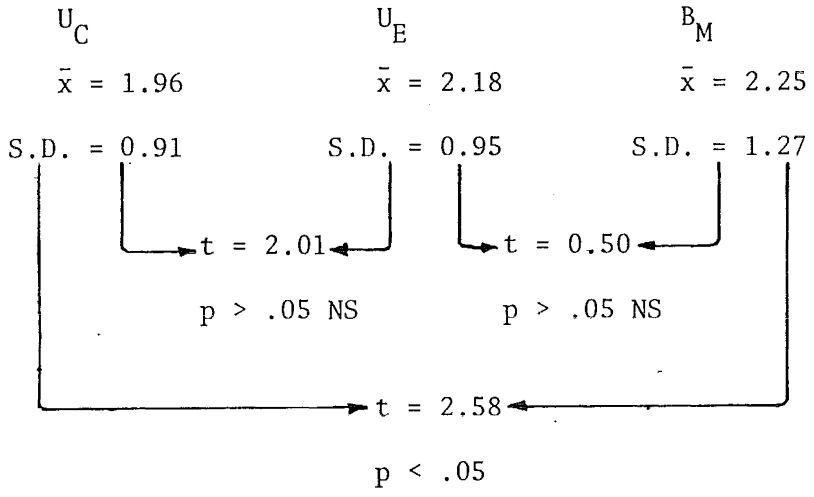
The t-tests were only significant between the U_C and the B_M lists comparison and between the U_E and the B_M lists comparison under the translation condition, thus supporting the List Type difference hypothesis (Table 3-7).

Table 3-8. t-Test for response time over Noncategorization/ Categorization x List Type Interaction

Noncategorization:



Categorization:



For the Noncategorization/Categorization by List Type interaction, the t-tests are significant at the .05 level between the U_C and the B_M lists comparisons for both categorized and noncategorized words. The t-test is significant at the .01 level between the U_E and the B_M lists comparison

for the noncategorized words. This indicates that there is a Noncategorization/Categorization difference among the lists (Table 3-8).

The two way interaction graphs are presented in Figures 3-7 to 3-9. An overall graph on all three factors on response time is presented in Figure 3-10. By inspection, the graphs exhibit very large differences in the Enunciation/Translation factor. The Noncategorization/Categorization factor and the List Type factors vary in their patterns.

5. OUTCOMES

The outcomes of the test phase from the bilingually-mixed lists was of interest and so another analysis of variance was performed. The three factors were Enunciation/Translation (2 levels), Outcome Type (3 levels), and Language Type (2 levels). The Language Type factor in this analysis simply refers to whether the items in the test phase were English words or Chinese characters. Again the mean response time referred to the time of response per item.

Three possible selections of outcomes of the recognition task were derived from the bilingually-mixed lists. The bilingually-mixed lists consisted of targets and distractors as defined in Chapter Two. The recognition task consisted of the subject picking out the targets from the distractors. The correct action was to select, as "old stimulus" response, only those items which occurred in that form in the study phase. This is referred to as the target selection. In addition to target selection, two other kinds of selection involving the distractors the subject might make:

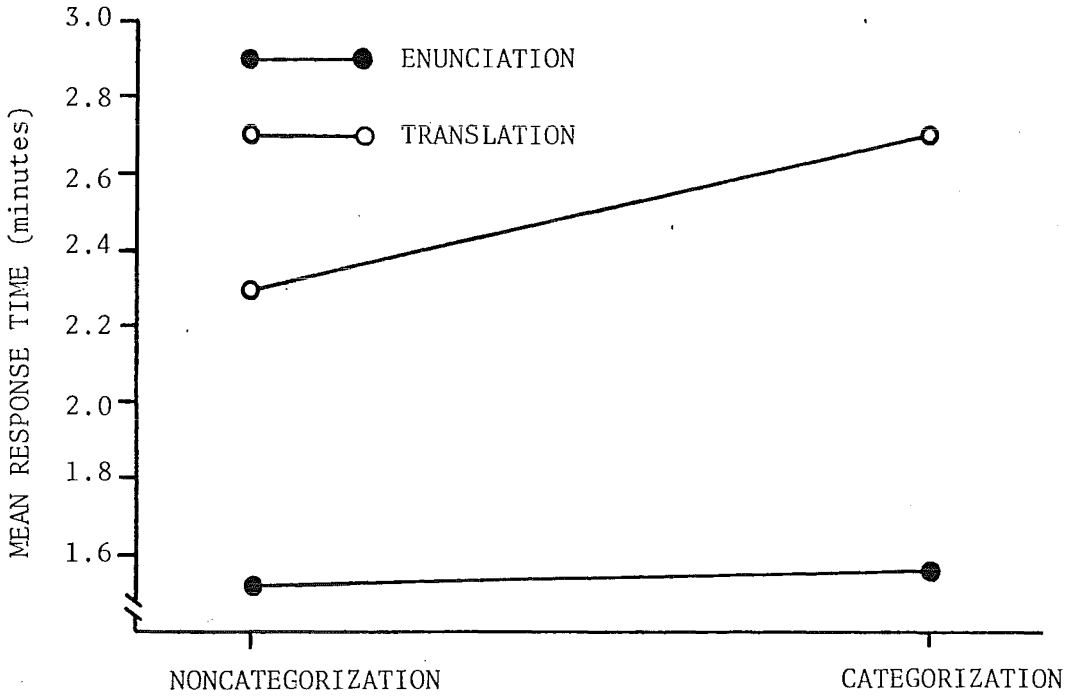


Figure 3-7. Mean response time over Enunciation/Translation x Noncategorization/Categorization interaction.

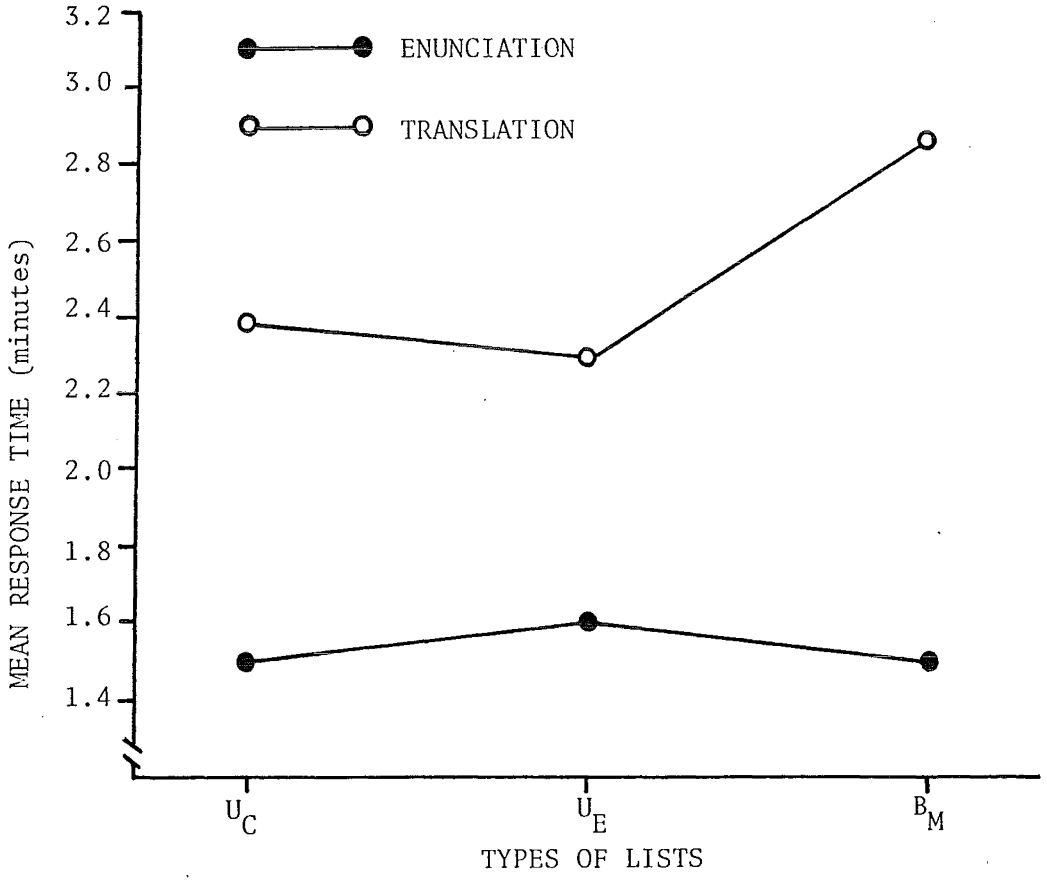


Figure 3-8. Mean response time over Enunciation/Translation x List Type interaction

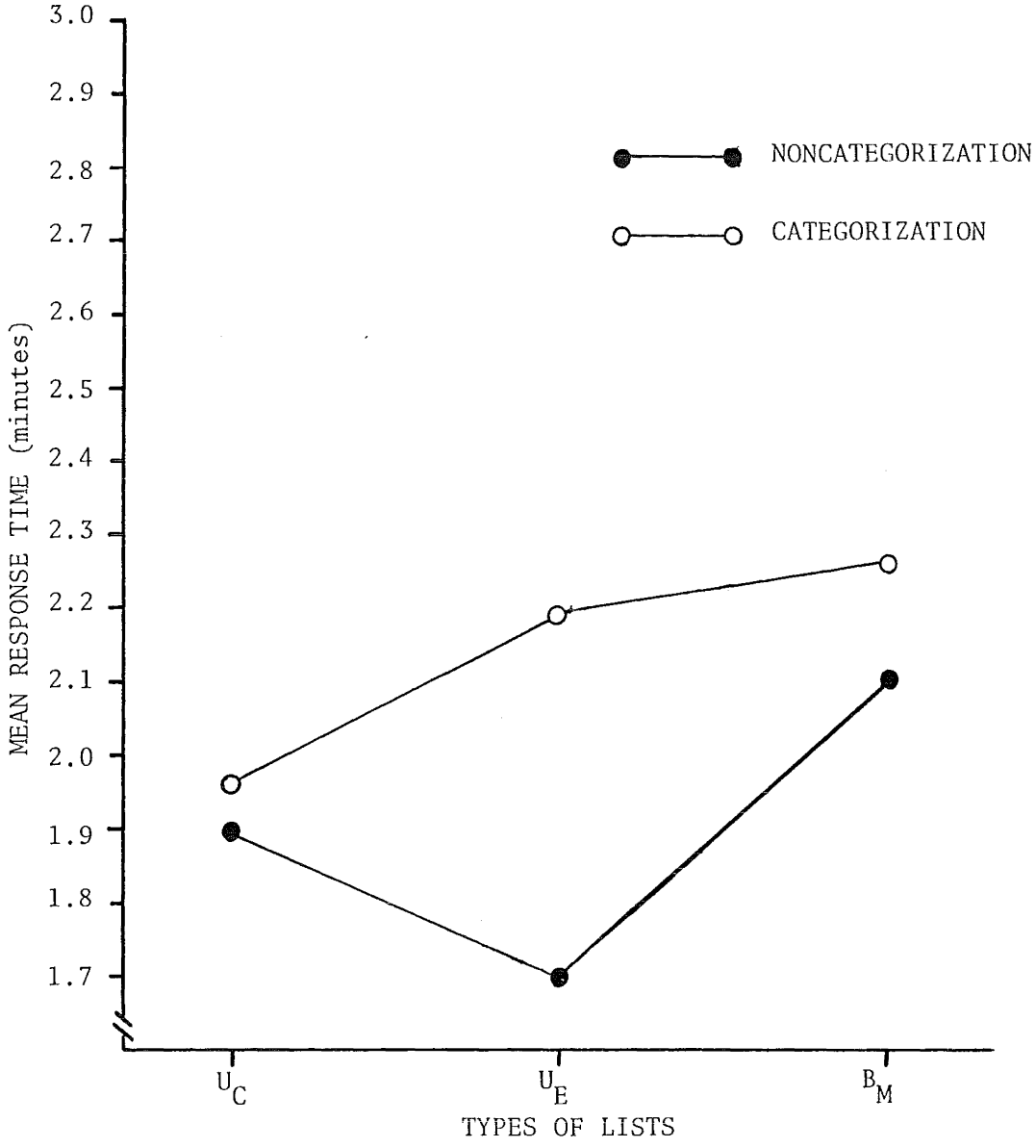


Figure 3-9. Mean response time over Noncategorization/ Categorization x List Type interaction

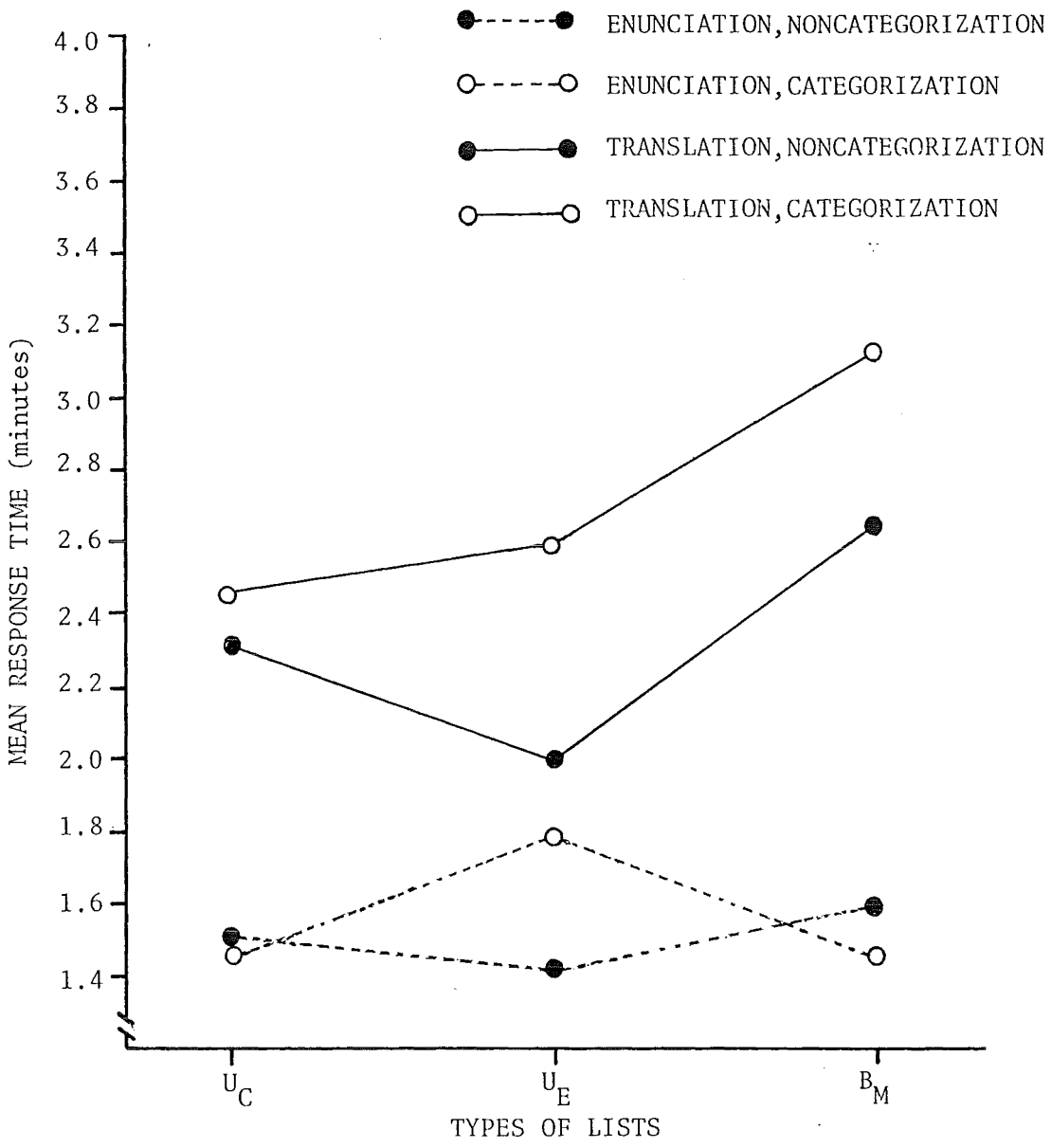


Figure 3-10. Mean response time over all three factors.

False target selection, the first kind, occurred when the subject considered the translation equivalent of a target stimulus as a "new" stimulus. For example, when presented with " 豆 " [= "bean"] in the study phase, s/he considered the English word "bean" in the test phase as "new" stimulus. Similarly, when presented with the English word "bean" in the study phase, s/he considered the character " 豆 " in the test phase as "new" stimulus.

The second kind of selection, the buffer selection, occurred when the subject considered an item which appeared in the test phase for the first time as a "new" stimulus. The item did not appear as part of the study phase at all.

Table 3-9. ANOVA summary of outcomes

Source	SS	df	MS	F	p
A	80.84	1,19	80.84	126.62	<.01
B	10.06	2,38	5.03	16.00	<.01
C	0.35	1,19	0.35	1.11	>.05 NS
AB	.91	2,38	0.46	1.76	>.05 NS
AC	1.78	1,19	1.78	7.33	<.05
BC	6.73	2,38	3.37	3.85	<.05
ABC	2.24	2,38	1.12	4.23	<.05

Key: Factor A : Enunciation/Translation
Factor B : Outcome Type
Factor C : Language Type

The Enunciation/Translation factor was significant at the .01 level, indicating that there was a large Enunciation/Translation difference in the response time. The effect of the Outcome Type factor was also significant at the .01 level. This indicated that there was a difference in the response time between the outcomes. The Language Type factor was not significant at all. The interaction between Enunciation/Translation factor and Language Type factor, and the interaction between Outcome Type factor and Language Type factor were significant at the .05 level. The interaction between all three factors was significant at the .05 level (Table 3-9).

Table 3-10. t-Tests of outcomes over Enunciation/Translation x Language Type Interaction

Enunciation:

Chinese item	English item
$\bar{x}$ = 1.96	$\bar{x}$ = 1.71
S.D. = 1.14	S.D. = 1.01

t = 1.68

p > .05 NS

Translation:

Chinese item	English item
$\bar{x}$ = 2.95	$\bar{x}$ = 3.05
S.D. = 1.10	S.D. = 1.42

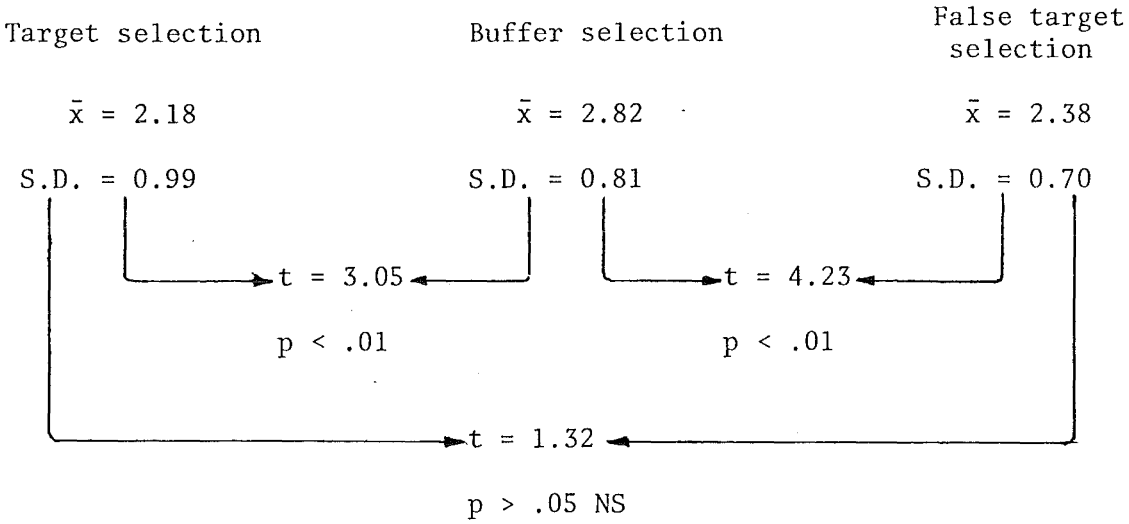
t = 0.86

p > .05 NS

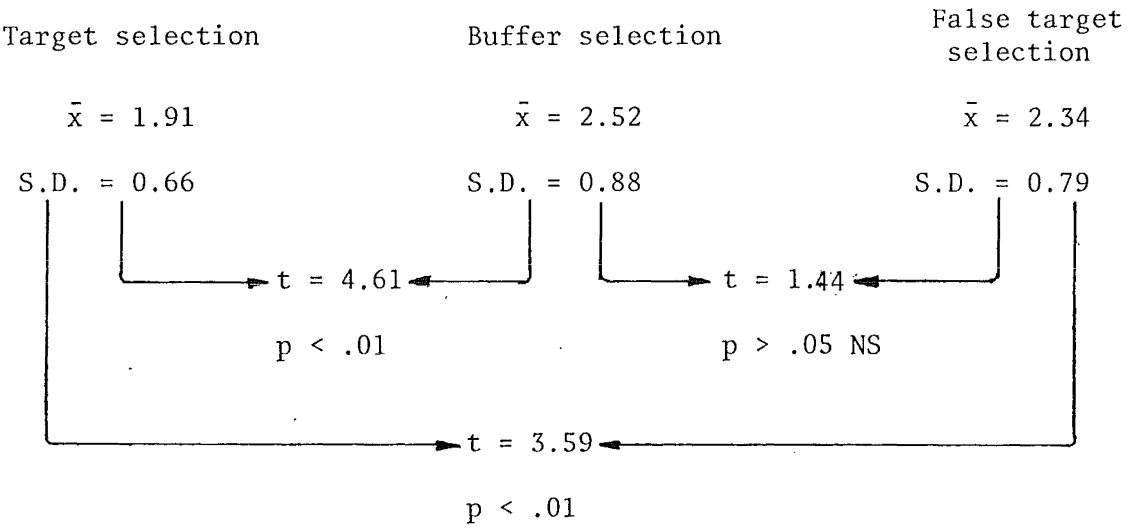
The t-tests are not significant between the Enunciation/Translation and the Language Type factors (Table 3-10).

Table 3-11. t-Test of outcomes over Outcome Type x Language Type Interaction

Chinese item:



English item:



For the Chinese items, the t-tests are all significant at the .01 level except the comparison between the target and the false target selections.

However, for the English items, the t-tests are significant at the .01 level except the t-test for buffer and false target selections (Table 3-11).

The response time graph of the outcome selections is presented in Figure 3-11. There are indications of a consistent pattern for both Chinese and English items.

6. TARGET ERRORS

The likelihood of forgetting a Chinese or an English target in a list was considered to be of interest. The errors made by subjects in mistaking the targets as "new" stimuli were analysed in a two way analysis of variance with repeated measures on both factors. The factors were errors made on Chinese or English targets (2 levels) and Enunciation/Translation (2 levels).

Table 3-12. ANOVA summary of target errors

Source	SS	df	MS	F	p
A	0.80	1,19	0.80	0.15	>.05 NS
B	61.25	1,19	61.25	14.87	<.01
AB	1.25	1,19	1.25	0.44	>.05 NS

Key: Factor A : Enunciation/Translation
Factor B : Error Type

The effect of the Error Type factor was significant at the .01 level. The Enunciation/Translation factor, and the Enunciation/Translation by Error Type interaction were not at all significant (Table 3-12).

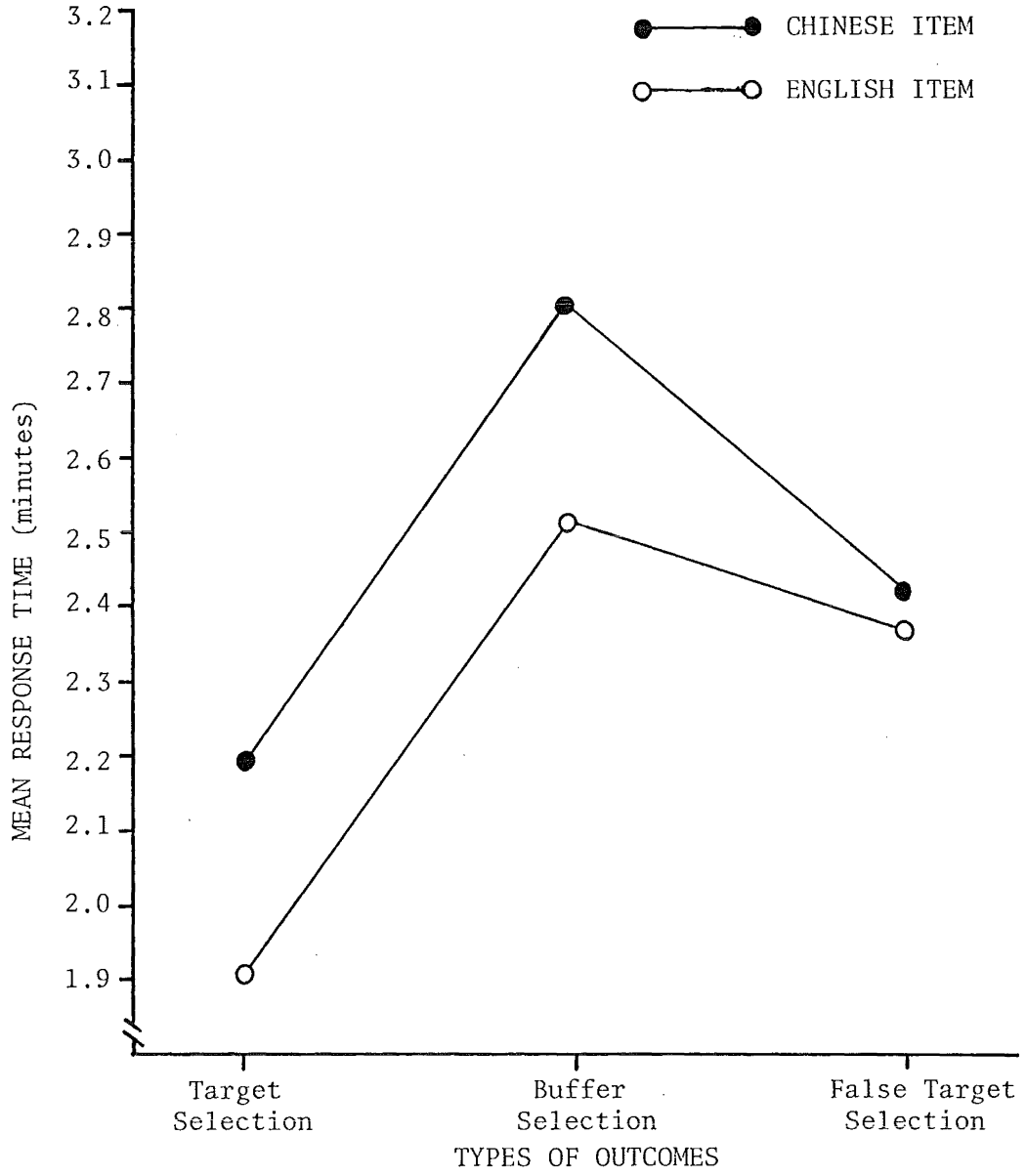


Figure 3-11. Mean response time over Outcome Type x Language Type interaction

Table 3-13. t-Tests of target errors over Enunciation/Translation x Error Type Interaction

Enunciation:

Errors on Chinese targets	Errors on English targets
$\bar{x}$ = 1.35	$\bar{x}$ = 3.35
S.D. = 1.10	S.D. = 2.85

t = 3.18

p < .01

Translation:

Errors on Chinese targets	Errors on English targets
$\bar{x}$ = 1.40	$\bar{x}$ = 2.90
S.D. = 1.70	S.D. = 2.49

t = 2.73

p < .05

The t-tests of target errors are significant, supporting the effect of the Error Type factor of forgetting Chinese or English target stimuli.

A graph is plotted to show the relation between the Enunciation/Translation factor and the Error Type factor (Figure 3-12). There are indications that subjects tend to forget items in their second language more easily than to forget items in their first language.

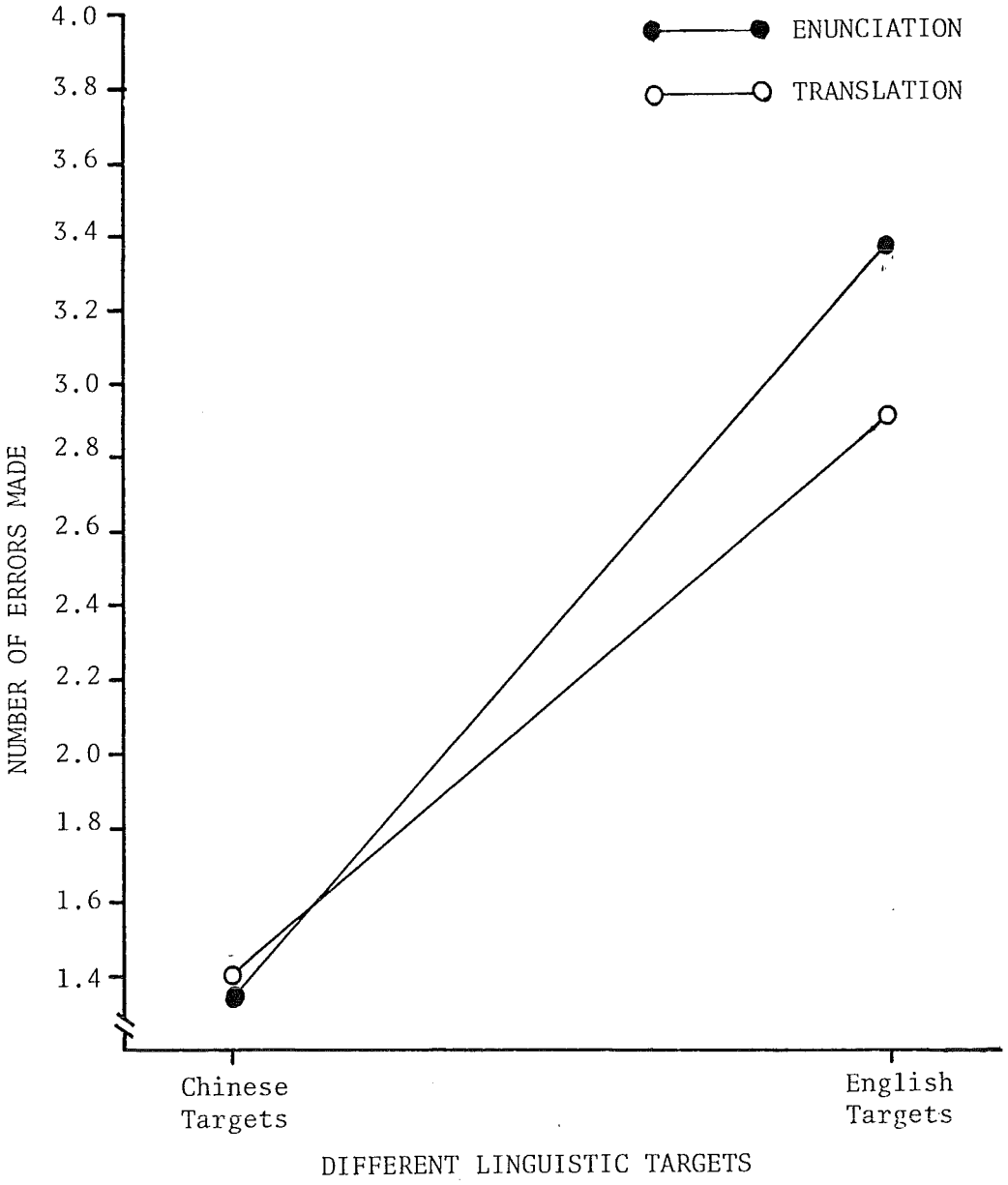


Figure 3-12. Number of errors made in Chinese and English targets

7. VERBAL RESPONSES

During the course of the experiment, the subjects' verbal responses were recorded. Only those items that were incorrectly enunciated or translated are discussed here. As mentioned before, no statistical analysis was performed. Instead, all the commonly mistranslated and misperceived symbols are illustrated.

Translation of languages is really never completely accurate and the translation in this experiment is no exception. But an interesting thing about translation is to examine the actual mistranslations.

The subjects' mistranslated verbal responses are tabulated (Table 3-14). The items in the parentheses are the translation equivalents of the items.

There are indications that bilinguals coded symbols according to their content and were not too concerned about accuracy of translation in daily usage. The content of a symbol could be semantically related to the content of another symbol from a similar category. For example, when presented with the word "autumn", a subject might translate the word into 冬 [= "winter"], the name of another season. This could cause a bilingual to mistranslate, particularly with categorized words. This suggestion is not analysed as it is beyond the scope of this experiment. However, an inspection of the mistranslated verbal responses tended to support the suggestion (Table 3-14).

Table 3.14. Mistranslated verbal responses

Actual stimulus presented		Mistranslated response	
autumn	[秋]	冬	[winter]
池	[pond]	lake	[湖]
洲	[continent]	state	[州]
turtle	[鼈]	龜	[tortoise]
肝	[liver]	lung	[肺]
kidney	[腎]	胃	[stomach]
kidney	[腎]	肝	[liver]
南	[south]	north	[北]
東	[east]	west	[西]
顙	[forehead]	neck	[頸]
warm	[暖]	熱	[hot]
minutes	[分]	秒	[seconds]
ginger	[薑]	蒜	[garlic]
hot	[熱]	燒	[burn]
cool	[涼]	冷	[cold]
錫	[tin]	solder	[釬]

In daily usage, two Chinese characters are often translated into one English equivalent. So it is not unusual to find mistranslated responses as the following:

(i) The item 野 [= "wild"] was translated as "field". If the character 田 is followed by 野 in Chinese text, it can, strictly speaking be translated as "field" with perhaps an underlying connotation of wilderness. However, in usual translation, the precise equivalent of "field" is " 田 ".
[The Chinese translation is rather more flexible than the English translation indicates].

(ii) The item 頭 [= "head"] was translated as "stone". The character 石 followed by the character 頭 can be translated as "stone". However, in the usual translation, the precise equivalent of "stone" is " 石 ".

(iii) In a slightly different vein, the character 氧 was enunciated as 氣 . The character 氧 followed by 氣 can be translated as "oxygen". In usual translation, the character 氣 means "gas" whereas the character 氧 means "oxygen".

During the event of the experiment, subjects often visually misperceived certain stimuli. The misperceived stimulus was often mistaken for some other Chinese or English symbol that had some similar shape or

structure to that of the stimulus. For example, the word "worship" appeared and the subject might misperceive the item as "warship" and hence, responded incorrectly.

The stimuli that were misperceived are tabulated below (Table 3-15). The symbols inside the parentheses are the translation equivalents of the Chinese items.

Table 3-15. Misperceived responses

Actual stimulus presented		Misperceived response	
爪	[claw]	瓜	[melon]
牛	[cow]	生	[live]
市	[city]	布	[cloth]
compress		compass	
哑	[mute]	噎	[kettle]
熟	[ripen]	熱	[warm]
powder		power	
worship		warship	
查	[scrutinize]	香	[incense]
灣	[bay]	彎	[bend]
膝	[knee]	漆	[paint]
sweat		sweet	
藍	[blue]	籃	[basket]
錫	[tin]	踢	[kick]
錫	[tin]	鉛	[lead]

Table 3-15 (Continued)

Actual stimulus presented		Misperceived response	
鋁	[aluminium]	鉛	[lead]
錨	[anchor]	貓	[cat]
鍋	[pan]	銅	[copper]
鎖	[lock]	鏈	[chain]
跪	[kneel]	跑	[run]
thread		threat	
clam		clamp	
怕	[afraid]	帕	[handkerchief]
needle		noodle	
雷	[thunder]	電	[electricity]

CHAPTER IV

DISCUSSION AND CONCLUSIONS

By visual inspection of the frequency polygons (Figures 3-1 to 3-4), it was apparent that the subjects rated themselves as more fluent in the Chinese language than in the English language. No obvious differences between the two languages can be detected from the verbal responses of the subjects. There are two possible explanations for this discrepancy. The first possibility is that subjects might consider their knowledge of the particular language as a whole when they were self-rating. However, the experimental stimuli only involved elementary Chinese and English items. Hence, the difference in the fluency of the two languages as rated by the subjects is not apparent from the subjects' verbal responses. The other possible explanation is that the Chinese language was the first language of all the subjects so subjects may feel more confidence in their knowledge of that language than in their second language. Thus, subjects might overestimate their abilities in the Chinese language or underestimate their abilities in the English language.

The data from the linear regression analyses (Table 3-1) show that there is a relationship between the reading time of a language and the self-ratings of that language. The more fluent the subject rated him/herself in a particular language, the less time the subject took to read the passages of that language.

By visual inspection of the raw data of reading time, all but one subject had slower reading time in the English passages than in the Chinese passages. Slower reading time in a particular language may mean that the subject is less fluent in that language. Hence, this is consistent with the data and gives support to Macnamara's findings (1969) that self-ratings and reading time are "the most satisfactory indirect measures" of the degree of bilingualism.

The results from the recognition performance show that there is an interaction between the Enunciation/Translation and the Noncategorization/Categorization factors (Table 3-2). Under the translation condition, categorization does not seem to facilitate recognition performance. In fact, subjects recognise fewer words under categorization than under noncategorization (Table 3-3 and Figure 3-5).

Looking at the response time of the subjects, there is also an interaction between Enunciation/Translation and Noncategorization/ Categorization (Table 3-5). Under the translation condition, there is a difference in response time between noncategorization and categorization (Table 3-6 and Figure 3-7).

The data seem to indicate that categorization neither facilitates recognition performance nor decreases response time under the translation condition. In fact, noncategorization has better recognition performance and a shorter response time than is the case for categorization. Under the enunciation condition, there is no significant difference in recognition performance or response time between noncategorization and categorization. The findings are not consistent with previous studies (Nott and Lambert, 1968; Segalowitz and Lambert, 1969) in which categorization facilitates recall and reaction time.

The analysis of variance of recognition performance shows that there is an interaction between the Noncategorization/Categorization factor and the List Type factor (Table 3-2). For the noncategorization factor (Table 3-4 and Figure 3-6), the unilingual lists (that is, U_C and U_E) show better recognition performance than the bilingually-mixed lists (B_M, $\bar{x}$ = 17.63), with the highest recognition performance from the Chinese unilingual lists ($\bar{x}$ = 18.68) and the second highest recognition performance from the English unilingual lists ($\bar{x}$ = 18.03). However, for the categorization factor (Table 3-4 and Figure 3-6), the English unilingual lists has the highest recognition performance ($\bar{x}$ = 18.48), the second highest recognition performance is from the Chinese unilingual lists ($\bar{x}$ = 17.78), and the poorest recognition performance is from the bilingually-mixed lists ($\bar{x}$ = 17.43). Hence, recognition performance is better with unilingual lists than with bilingually-mixed lists under either noncategorization or categorization.

Noncategorized, bilingually-mixed lists ($\bar{x}$ = 2.10) take longer to respond to an item than that from the noncategorized, Chinese unilingual lists ($\bar{x}$ = 1.89) or from the noncategorized, English unilingual lists ($\bar{x}$ = 1.71). See Table 3-8 and Figure 3-9. For categorization, the response times per item from the Chinese unilingual lists ($\bar{x}$ = 1.96) and from the English unilingual lists ($\bar{x}$ = 2.18) are shorter than from the bilingually-mixed lists ($\bar{x}$ = 2.25). Thus, the unilingual lists have shorter response times as compared to the bilingually-mixed lists.

As a whole, unilingual lists exhibit better recognition performance and less response time as compared to the bilingually-mixed lists. However, the differences between each type of list vary in their levels

of statistical significance (see Tables 3-4 and 3-8). The increase in time taken to respond to an item from bilingually-mixed lists as opposed to unilingual lists can be accounted by the constant switching from one language to the other. This longer length of time is consistent with the findings of Macnamara and Kushnir (1971).

There is no noticeable significant difference in the recognition performance between the Enunciation/Translation and the List Type factors (Table 3-2). But there is a vast difference in the response times between the above mentioned factors (Table 3-7 and Figure 3-8). Hence, the results are consistent with the postulation that translation only slows down response time but has no effect on the recognition task.

In the case of the three outcome selections (Table 3-11 and Figure 3-11) of the Chinese items, the shortest response time per item occurs with target selection ($\bar{x}$ = 2.18); the second shortest response time occurs in the false target selection ($\bar{x}$ = 2.38); and the longest response time is found in buffer selection ($\bar{x}$ = 2.82). A similar pattern is obtained for the English items. The English target selection has the shortest response time per item ($\bar{x}$ = 1.91); the second shortest response time occurs with the false target selection ($\bar{x}$ = 2.34); and the longest response time comes from buffer selection ($\bar{x}$ = 2.52).

The pattern that emerges is that target selection has the shortest response time for both languages. This is as expected since the subjects saw the items for a second time and hence, familiarization could be expected to occur. (The first time the subjects saw the items was during the study phase of the lists.) The false target selection is between

the buffer and the target selections. If subjects make use of the language scheme only, then the false target selection should produce equivalent response times to those found in the buffer selection. This is because the actual false target item is seen for the first time in that language during the test phase. However, the false target's word concept has appeared before in a different language (see Chapter III, Section 5 for the definition of false target selection). Thus, the results indicate that the semantic scheme may be involved in mental processing. This indicates that Chinese false target selection was more sensitive to the meaning of the word concept than English false target selection. We have noted previously that Tweedy and Lapinski (1981) have suggested that semantic processing is a relatively automatic phenomenon.

The number of errors made when an item fails to be recognised is significantly larger for an English item than for a Chinese item in a list (Table 3-13). From the raw data, subjects are more likely to forget the targets in their second language than to forget the targets in their native language.

Judging from the self-ratings and the reading times of the subjects (Figures 3-1 to 3-4 and Table 3-1), it may be said that Chinese language is the dominant language of the subjects and English language is the nondominant language. From the results of the errors made in recognizing a Chinese or an English target, it can be concluded that superior recognition performance of the nondominant language is not observed in this study at all. This is consistent with the findings of McCormack et al. (1979).

There are two possible explanations for the above. The first possibility is that subjects may give rehearsal priority to the dominant language items. However, previous studies demonstrated that rehearsal priority occurs in the dominant language items only in primary memory (Nott and Lambert, 1968; Tulving and Colotha, 1970). The other possible explanation is that since Chinese characters are ideographic in written representation (see Chapter I, Section 6) whereas English words are phonological in written representation, then the difference is making errors in recognizing Chinese or English items may be due to the difference in the graphic representation of the languages. Chinese characters may have a more deep-rooted schema than the English words because of its ideographic representation.

The verbal mistranslated responses of the subjects show that the contents of the mistranslated responses are usually semantically related to the actual stimuli (Table 3-14). There are two alternative explanations for this. Firstly, subjects were not precise in their translations. For example, 南 [= "south"] was translated as "north". Evers (1970) reported that subjects were not very precise about linguistic equivalence in translation. An alternative explanation is that some Chinese characters share common primitives. So subjects are more likely to mistake a character for another character because of the common primitives. For example, 額 [= "forehead"] is mistranslated as "neck" [= 頸].

From the verbal responses, it was detected that subjects occasionally misperceived the stimuli at the time of presentation. The items to which they verbally responded usually shared some structure or shape that was similar to the stimuli presented. For example, "worship" was misperceived

as "warship", or  [= "tin"] was misperceived as  [= "kick"]. This indicates that structures or shape of items do play a noticeable role in word perception and should not be ignored. The findings relating to these misperceived stimuli provide suggestions for future studies to be done, for example, to examine any specific structures or features that are selectively attended to in quick scanning tasks.

As mentioned before, little is known about the comparison between Sino-Tibetan language and Indo-European language and very few studies in the field of bilingualism have made use of the Chinese language. Hence, one of the problems the author found initially was to establish a word pool of common items. So an important area for further study is to establish a set of Chinese items that can be used by others interested in using Chinese characters as part of their studies.

One of the chief handicaps within the present study is the response time measure. In the present study,response time was used because the author wanted to ensure that the subjects did perceive the items and were familiar with their meanings. Ideally, reaction time (that is, the time taken to react to a particular item) should be used. However, as the author was primarily interested in examining the enunciation versus translation factor, response time (that is, the time taken to respond verbally and to react to each item) was considered to be the appropriate measure of the two. Perhaps, future studies can use a reaction time measure and hence, provide a more sensitive measure than the present study.

One of the chief weaknesses of the study is that there are too many factors embedded and intertwined with each other. This makes it difficult

to pinpoint exactly what is going on. It would be more appropriate if the study had been divided into several smaller studies, looking at one or two variables at any one time.

It must be accepted that bilingualism is by and large a social phenomenon. Bartlett (1932) suggested that there "is no doubt that much of human remembering is influenced directly and strongly by factors which are social in origin". In the life of most bilinguals, languages take place in different social settings (for examples, see Southworth, 1980). The need to observe bilingualism in its natural habitat is essential before complete understanding of bilingualism is possible.

This study was centred on four hypotheses. The first hypothesis, that categorization will facilitate recognition performance and will decrease response time as compared to noncategorization, is not supported. While other studies have shown that categorization facilitates recall and decreases reaction time (Nott and Lambert, 1968; Segalowitz and Lambert, 1969), the results of this study indicate that categorization does not facilitate recognition performance or decrease response time.

The recognition performances and the response times observed with unilingual lists and bilingually-mixed lists provide partial support to the second hypothesis. The second hypothesis states that equivalent recognition performance will be obtained from unilingual and bilingually-mixed lists under both enunciation and translation conditions, and that under the translation condition, the response time of the recognition task will be longer than the response time under the enunciation condition. Under both the enunciation and the translation

conditions, the unilingual lists show higher recognition performance than the bilingually-mixed lists. However, the differences are not significant in all cases. While the time taken to respond to an item in the different lists varies, the response time under translation condition is consistently longer than the response time under the enunciation condition.

The third hypothesis states that false target selection will take longer to respond to, than is the case for target or buffer selection. This hypothesis is not supported. False target selection takes a longer time to respond to than target selection but less time than buffer selection. For the English false target selection, the response time per item is close to the English buffer selection. This seems to suggest that the mental processes involved in the English false target selection is no different than that found in the English buffer selection. But the Chinese false target selection is closer to the Chinese target selection. This seems to imply that the mental processes involved in the Chinese false target and the Chinese target selections are similar.

The last hypothesis, that there may be differences between the number of Chinese items and the number of English items recognized in a list, is supported. From the raw data, it seems that subjects are consistently more likely to recognise the Chinese items than the English items. The analysis of variance (Table 3-13) also supports this hypothesis.

From the findings of this study, the two main hypotheses (that is, Hypotheses Number Three and Four) indicate different underlying cognitive processes which seem to arise as a consequence of the graphic representation of the languages. The findings of the third hypothesis

indicate that the Chinese false target selection is closer in response time to the Chinese target selection than to the Chinese buffer selection. This pattern is not evidenced in the English case where the false target selection is closer to the buffer selection than to the target selection. The findings of the fourth hypothesis demonstrate that the mental retention of the Chinese items is greater than that of the English items. These seem to suggest that something about the graphic representation of the Chinese language affects cognitive processing. The differences in cognitive processing between English and Chinese languages may arise from the fact that Chinese language uses ideographic representation while English language does not.

As graphic representation seems to be the process underlying the differences tested by the two main hypotheses, it is suggested by the author that this aspect of bilingualism should be studied in greater depth.

The independence-interdependence controversy has led the author to suggest that previous studies have been investigating bilingualism from different viewpoints. Therefore, the author believes that only when bilingualism is studied from a wide range of different aspects will a unified theory emerge. Perhaps this unified theory will encompass the present, often conflicting models which are thought to represent different aspects of bilingualism. This may be particularly true of conflict between the independence and the interdependence models.

This study was designed as an attempt to provide information on the cognitive processes involved in bilingualism. To date, little research has been done in this field. Therefore, much extensive research remains to be done to understand the many different aspects of bilingualism.

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APPENDIX A

READING PASSAGES IN ENGLISH

(1)

There once lived a Chinese emperor who was very much worried because the queen failed to bear him a male heir to his throne, to succeed him after his death. He thought seriously of taking another concubine. The queen was very much upset upon learning this. She threatened suicide if the emperor took another wife.

However the emperor thought she was only pretending. Since he was anxious to find out if the queen meant it seriously, he devised the following scheme. He placed a bowl of vinegar before her, saying that it was a bowl of arsenic poison and that is she wanted to kill herself, this would be the most opportune moment. The queen drank the contents of the bowl, not knowing that she was only drinking vinegar. The emperor, upon seeing this, was deeply moved, and swore that he would never take another wife.

(2)

Those who can do, those who cannot, criticise. This has only a grain of truth in so far as art, or music, is concerned. When a person looks at a painting his opinion of it and attitude towards it are governed largely by his own turn of mind, ideals, education and experience. It can therefore be said that criticism is personal. If you accept this then you have to accept everybody's judgement to be valuable. But it is absurd. This matter of personal taste now presents difficulty and the question of authority in matters of art arises. Who or what is the criterion by which a painting is judged? Although some assert that only time can decide, there are however a few general standards by which a piece of work is judged.

READING PASSAGES IN CHINESE

(1)

一個懶惰的青年，整天閒逛。但是，他總覺得不痛快。一天，他看見一個年老的農民在扒土。他問農民："老大爺，你知道哪兒能夠找到痛快嗎？"農民看了他一眼，說："我知道，不过我要扒土，沒有工夫對你說。"青年說："我代替你扒土，好嗎？"農民說："好，讓我想一會。"過了一會，農民看見青年已經滿身流汗，同他到一棵大樹下面休息。一陣風吹來。青年覺得涼快而舒服，連聲說："真痛快，真痛快！"

(2)

從前，牛看貓只有老鼠那麼大，看大人只有小孩兒那麼大，把甚麼都不放在眼睛里。他橫冲直撞，常常闖禍。

有一個仙人，把牛的眼睛換給 我鳥，把我鳥的眼睛換給牛。從此，牛看老鼠有貓那麼大，看小孩兒有大人那麼大。一個五六歲的小孩兒就能夠看管他，叫他馴服地幫助人們耕種。我鳥呢，換了牛的眼睛，胆子大起來了，甚麼也不怕。不管誰走過，他伸長膀子，張開翅膀，一面叫，一面追。

APPENDIX B

QUESTIONNAIRE IN ENGLISH

UNIVERSITY OF CANTERBURY DEPARTMENT OF PSYCHOLOGY

This experiment is part of a Masters degree in Psychology. It attempts to investigate the way that bilinguals store their languages in their memory, and the way that various pieces of information are processed in their memory. In this experiment, the languages involved are the English and Chinese languages. While answering the questionnaire, please note that where the Chinese language is mentioned, it is inclusive of all Chinese dialects and not just Mandarin.

Your responses to this experiment will be greatly appreciated and confidentiality will be strictly maintained.

Mr/Ms: _____

Age: _____

1. Number of years residing in N.Z. _____

2. Course you are doing in university _____

3 (a) What language is your mother tongue? _____

(b) If CHINESE, what dialect/s do you speak at home in your native country? _____

4. Write down all the languages you can speak, write or understand. (In the case of CHINESE, specify the dialects).

_____

5. State the educational level of your MANDARIN (e.g. Primary 3,6, or Chinese Junior, or Middle Senior).

_____

6. State the total length of time that you have been educated in ENGLISH medium institutions.

_____

7. (a) What language/s do you usually think in? _____

(b) If more than one, indicate the situations when you think in a particular language.

CHINESE _____

ENGLISH _____

OTHERS _____

8. Which is your most expressive language?

(i) CHINESE ☐

(ii) ENGLISH ☐

(iii) OTHERS ☐ Please specify: _____

9. (a) Since residing in N.Z., do you still use the CHINESE language?

(i) Yes ☐

(ii) No ☐

(iii) Sometimes ☐

(b) If so, specify in what ways. (You can tick as many as appropriate).

(i) ☐ in reading materials, e.g. books, magazines, etc.

(ii) ☐ in conversations

(iii) ☐ in correspondence

(iv) ☐ in music, e.g. listening to CHINESE songs, etc.

(v) ☐ others. Please specify _____

10. Circle the appropriate number where you think you are best positioned along each of the scales:-

(a) when speaking in CHINESE

1 2 3 4 5 6 7

very poor very fluent

(b) when listening to CHINESE

1 2 3 4 5 6 7

very poor very fluent

(c) when reading in CHINESE

1 2 3 4 5 6 7

very poor very fluent

(d) when writing in CHINESE

1 2 3 4 5 6 7

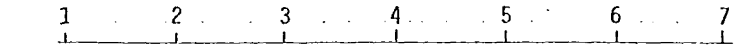
very poor very fluent

(e) when speaking in ENGLISH

1 2 3 4 5 6 7

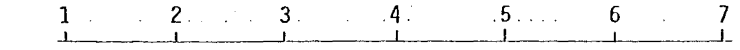
very poor very fluent

(f) when listening to ENGLISH



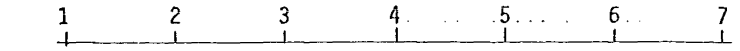
very poor very fluent

(g) when reading in ENGLISH



very poor very fluent

(h) when writing in ENGLISH



very poor very fluent

You will be given two passages to read aloud. When the passages are in the ENGLISH language, read in ENGLISH. When they are in the CHINESE language, read in CHINESE. Read accurately and with comprehension.

When you are ready to start reading, inform the experimenter.

QUESTIONNAIRE IN CHINESE

這項試驗是心理系碩士文憑的一部份。動機是調查兩種語言如何地被記憶在腦海中與及如何聯想。在這項試驗內，有關係之語言是英文及華文。在答案問題時，留意華文語言是包括所有華語方言，而非華文而已。

這項試驗絕對保密。謝謝你的合作。

_____ 先生/小姐

年齡：_____ 歲

(1.) 已在紐西蘭逗留多少年？_____ 年.

(2.) 你在大學是唸什么系？_____ 系.

(3.) a. 母語是_____ 語言。

b. 若是華文，在家里是操、講什么方言？

_____

(4.) 寫下你會說/寫/瞭解之所有語言？（至於华文，須列明方言。）

_____

(5.) 你的華文的教育程度是？例如小学三年級，六年級；或初中，高中等。

_____

(6.) 你在以英文作教学媒介的学院受教育多久？

_____

(7.) a. 你通常是以什么語言思索？

_____

b. 若是超过一種語言，寫明你在什么情況使用下列各語言

华文 _____

英文 _____

其他語言 _____

(8.) 那種語言最能表達你的意見？

(i) 华文 ☐

(ii) 英文 ☐

(iii) 其他語言 ☐ 請說明：_____

(9.) a. 當你逗留在紐西蘭期間，你是否有應用到华文？

(i.) 時常 ☐

(ii.) 沒有 ☐

(iii.) 有時候 ☐

b. 若是常有，說明在何情形之下。(在下列格內打 ✓)。

(i.) ☐ 閱讀時，如書籍，雜誌等。

(ii.) ☐ 交談時。

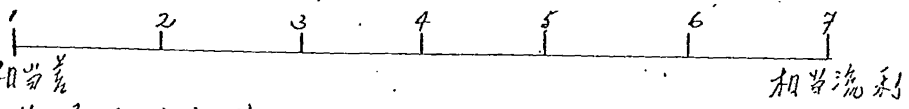
(iii.) ☐ 通信時。

(iv.) ☐ 傾听音樂：如华語歌曲等。

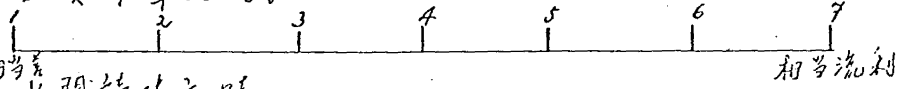
(v.) ☐ 其他。請說明：_____

(10.) 在下列的比例尺上圈上你的能力。

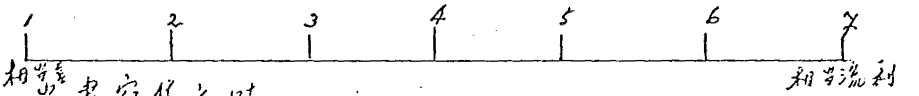
a. 当以华文交談時。



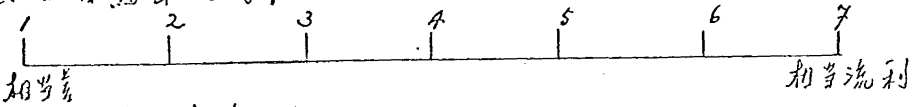
b. 当傾听华文時。



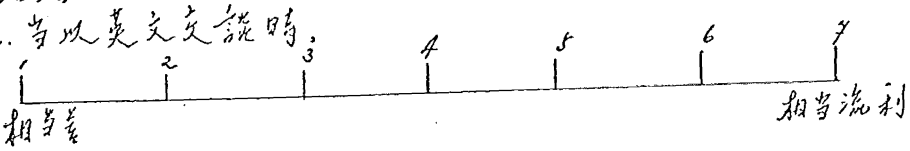
c. 当閱讀华文時。



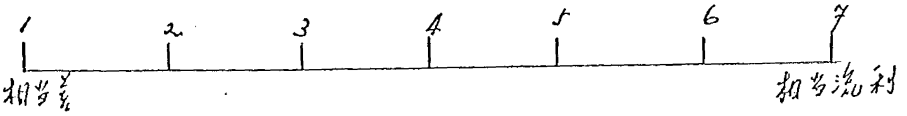
d. 当書寫华文時。



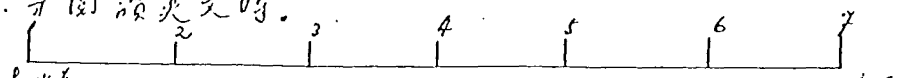
e. 当以英文交談時。



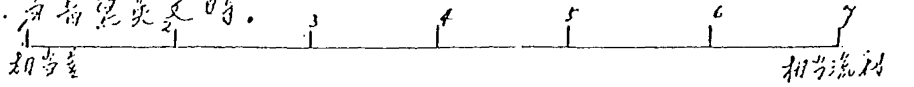
f. 当傾听英文時。



9. 当閱讀英文時。



10. 当看寫英文時。



你會被給予兩段短文大声地讀出來。若該段是英文語言，就以英語讀出來。若該段是 华文語言，就以华語讀出來。要瞭解及準確地讀出。

当你預備好開始唸讀，通知試驗者。

APPENDIX C

STIMULI IN THE LISTS

1. CHINESE UNILINGUAL LIST (ENUNCIATION)

Study phase:

1. 雷	5. 香	9. 說	13. 稅	17. 筆
2. 尿	6. 鍋	10. 等	14. 左	18. 吃
3. 飯	7. 趕	11. 氧	15. 鈍	19. 帝
4. 查	8. 多	12. 飛	16. 袋	20. 吸

Test phase:

1. 蛋	9. 麻	17. 飯	25. 市	33. 氧
2. 查	10. 說	18. 況	26. 紀	34. 等
3. 稅	11. 吸	19. 蛙	27. 田	35. 夜
4. 犁	12. 香	20. 箭	28. 尿	36. 谷
5. 朝	13. 春	21. 鍋	29. 筆	37. 飛
6. 南	14. 絲	22. 左	30. 袋	38. 冰
7. 雷	15. 趕	23. 棚	31. 堡	39. 多
8. 鈍	16. 敞	24. 吃	32. 月	40. 背

2. ENGLISH UNILINGUAL LIST (ENUNCIATION)

Study phase:

1. pelvis	6. straight	11. scorpion	16. poor
2. friendship	7. item	12. vapour	17. charcoal
3. page	8. hammer	13. spinach	18. invest
4. corn	9. earth	14. narrow	19. cactus
5. near	10. yacht	15. punish	20. trawler

Test phase:

1. prayer	11. slow	21. molar	31. bureau
2. yacht	12. hammer	22. speech	32. punish
3. page	13. charcoal	23. invest	33. cactus
4. corn	14. think	24. spinach	34. nephew
5. straight	15. occasion	25. pelvis	35. correct
6. blender	16. vapour	26. robe	36. poor
7. strength	17. narrow	27. item	37. summer
8. thirsty	18. precious	28. shine	38. mercury
9. rhombus	19. friendship	29. trawler	39. near
10. earth	20. telescope	30. scorpion	40 rainbow

3. BILINGUALLY-MIXED LIST (ENUNCIATION)

Study phase:

1. pillar	6. 爛	11. compress	16. 岸
2. 粥	7. 睡	12. paper	17. smooth
3. 空	8. chair	13. 零	18. glacier
4. winter	9. 塔	14. 風	19. 密
5. 沙	10. play	15. garden	20. real

Test phase:

1. 家	11. 岸	21. bundle	31. garden
2. winter	12. pillar	22. real	32. 賊
3. 玩	13. 零	23. caravan	33. sand
4. 爛	14. wheat	24. 塔	34. 椅
5. station	15. smooth	25. 酵	35. 空
6. 風	16. play	26. paper	36. 瘦
7. fragile	17. 冬	27. 密	37. tower
8. sleep	18. porridge	28. glacier	38. 粥
9. 沙	19. compress	29. zero	39. 散
10. 真	20. 紙	30. 睡	40. chair

4. CATEGORIZED, CHINESE UNILINGUAL LIST (ENUNCIATION)

Study phase:

1. 牛	6. 手	11. 盤	16. 杯
2. 苦	7. 碗	12. 嚷	17. 唱
3. 臉	8. 甜	13. 酸	18. 胸
4. 辣	9. 叫	14. 腰	19. 獅
5. 哭	10. 鹿	15. 貓	20. 碟

Test phase:

1. 甘	11. 手	21. 辣	31. 貓
2. 靜	12. 哼	22. 叫	32. 腿
3. 瓶	13. 甜	23. 嘴	33. 匙
4. 牛	14. 杯	24. 腰	34. 虎
5. 耳	15. 狼	25. 熟	35. 哭
6. 壺	16. 臉	26. 鹹	36. 胸
7. 唱	17. 酸	27. 碟	37. 鹿
8. 目	18. 嚷	28. 獅	38. 筷
9. 嫩	19. 豹	29. 笑	39. 猴
10. 碗	20. 盤	30. 苦	40. 喊

5. CATEGORIZED, ENGLISH UNILINGUAL LIST (ENUNCIATION)

Study phase:

1. termite	6. fearless	11. prolong	16. extend
2. heroic	7. brave	12. flute	17. trumpet
3. wasp	8. cello	13. farmer	18. elongate
4. doctor	9. juggler	14. cymbal	19. mosquito
5. lengthen	10. locust	15. bold	20. cobbles

Test phase:

1. stretch	11. builder	21. guitar	31. farmer
2. violin	12. drum	22. juggler	32. expand
3. manager	13. fearless	23. protract	33. moth
4. locust	14. doctor	24. elongate	34. gallant
5. bold	15. trumpet	25. bee	35. termite
6. flute	16. brave	26. butcher	36. cello
7. cobbler	17. lengthen	27. wasp	37. widen
8. beetle	18. artist	28. extend	38. respectable
9. prolong	19. honourable	29. piano	39. cymbal
10.heroic	20. cockroach	30. courageous	40. mosquito

6. CATEGORIZED, BILINGUALLY MIXED LIST (ENUNCIATION)

Study phase:

1. walk	6. kneel	11. gold	16. 梨
2. 奶	7. 跑	12. 跳	17. beer
3. iron	8. 傻	13. weak	18. 銀
4. ugly	9. wine	14. 銅	19. 茶
5. 橙	10. plum	15. 笨	20. peach

Test phase:

1. 傻	11. wine	21. 奶	31. 醜
2. 窮	12. 橙	22. wicked	32. steel
3. beer	13. 笨	23. 桃	33. 踢
4. peach	14. jump	24. 銅	34. almond
5. crawl	15. 跑	25. gold	35. iron
6. 金	16. weak	26. 酒	36. kneel
7. tea	17. pears	27. silly	37. 茶
8. 喱	18. 鋁	28. walk	38. whisky
9. 醋	19. plum	29. 跪	39. copper
10. 銀	20. ugly	30. 梨	40. 跳

7. CHINESE UNILINGUAL LIST (TRANSLATION)

Study phase:

1. 橋	6. 罪	11. 蛇	16. 軟
2. 湯	7. 老	12. 病	17. 夢
3. 床	8. 痛	13. 貴	18. 網
4. 書	9. 野	14. 蟲	19. 洞
5. 花	10. 星	15. 偷	20. 毒

Test phase:

1. 布	11. 考	21. 淺	31. 野
2. 蟲	12. 掌	22. 米	32. 病
3. 橋	13. 父	23. 雨	33. 斧
4. 東	14. 蛇	24. 花	34. 蓋
5. 洞	15. 書	25. 夢	35. 床
6. 星	16. 會	26. 罪	36. 網
7. 詩	17. 毒	27. 軟	37. 貴
8. 痛	18. 蜜	28. 兵	38. 糕
9. 停	19. 錨	29. 鎖	39. 偷
10. 放	20. 寫	30. 湯	40. 亮

8. ENGLISH UNILINGUAL LIST (TRANSLATION)

Study phase:

1. thread	6. bird	11. north	16. teach
2. bamboo	7. car	12. gun	17. late
3. sweat	8. dark	13. blow	18. autumn
4. new	9. fire	14. deaf	14. blood
5. salt	10. knife	15. water	20. umbrella

Test phase:

1. teach	11. far	21. gun	31. shoe
2. west	12. late	22. umbrella	32. road
3. grass	13. oil	23. north	33. sugar
4. car	14. autumn	24. lamp	34. bird
5. donkey	15. fast	25. knife	35. thread
6. escape	16. fire	26. sweat	36. dark
7. blood	17. leather	27. melt	37. blow
8. mountain	18. salt	28. deaf	38. require
9. temple	19. pearl	29. allow	39. year
10. water	20. new	30. flag	40. bamboo

9. BILINGUALLY-MIXED LIST (TRANSLATION)

Study phase:

1. 球	6. 針	11. 閲	16. noodle
2. short	7. powder	12. arrival	17. 龍
3. 死	8. stone	13. 船	18. false
4. 爪	9. 深	14. open	19. wide
5. letter	10. 債	15. worship	20. 雲

Test phase:

1. fork	11. deep	21. 鬼	31. false
2. 矩	12. 龍	22. 死	32. 麺
3. ladder	13. 球	23. arrival	33. powder
4. needle	14. noodle	24. stone	34. 閲
5. 船	15. wide	25. 開	35. 肥
6. short	16. wear	26. die	36. 債
7. 石	17. 爪	27. 針	37. use
8. 肉	18. open	28. 信	38. 桶
9. letter	19. read	29. worship	39. 雲
10. hair	20. 鍋	30. ball	40. 深

10. CATEGORIZED, CHINESE UNILINGUAL LIST (TRANSLATION)

Study phase:

1. 白	6. 海	11. 剪	16. 打
2. 頭	7. 頸	12. 湖	17. 黃
3. 島	8. 鷹	13. 黑	18. 膝
4. 鴿	9. 紅	14. 殺	19. 洲
5. 砍	10. 脚	15. 鴨	20. 鷄

Test phase:

1. 拍	11. 刺	21. 指	31. 湖
2. 汀	12. 鴨	22. 黑	32. 紫
3. 灰	13. 紅	23. 切	33. 脚
4. 頭	14. 頸	24. 鳳	34. 殺
5. 鴿	15. 洋	25. 藍	35. 鷄
6. 池	16. 鷹	26. 洲	36. 灣
7. 摸	17. 砍	27. 鷗	37. 膝
8. 鵝	18. 黃	28. 腕	38. 海
9. 白	19. 頸	29. 青	39. 島
10. 腸	20. 燕	30. 剪	40. 打

11. CATEGORIZED, ENGLISH UNILINGUAL LIST (TRANSLATION)

Study phase:

1. seconds	6. learn	11. stool	16. fish
2. hot	7. dry	12. shark	17. cool
3. win	8. yard	13. wet	18. receive
4. crab	9. hold	14. inch	19. wall
5. door	10. prawn	15. window	20. mile

Test phase:

1. room	11. feet	21. window	31. clam
2. whale	12. have	22. shark	32. mile
3. learn	13. minutes	23. pounds	33. crab
4. stuffy	14. cold	24. receive	34. burn
5. prawn	15. buy	25. seconds	35. table
6. cool	16. hall	26. fish	36. inch
7. kati	17. turtle	27. obtain	37. tortoise
8. hold	18. yard	28. stair	38. wall
9. door	19. win	29. stool	39. dry
10. warm	20. pick	30. hot	40. wet

12. CATEGORIZED, BILINGUALLY-MIXED LIST (TRANSLATION)

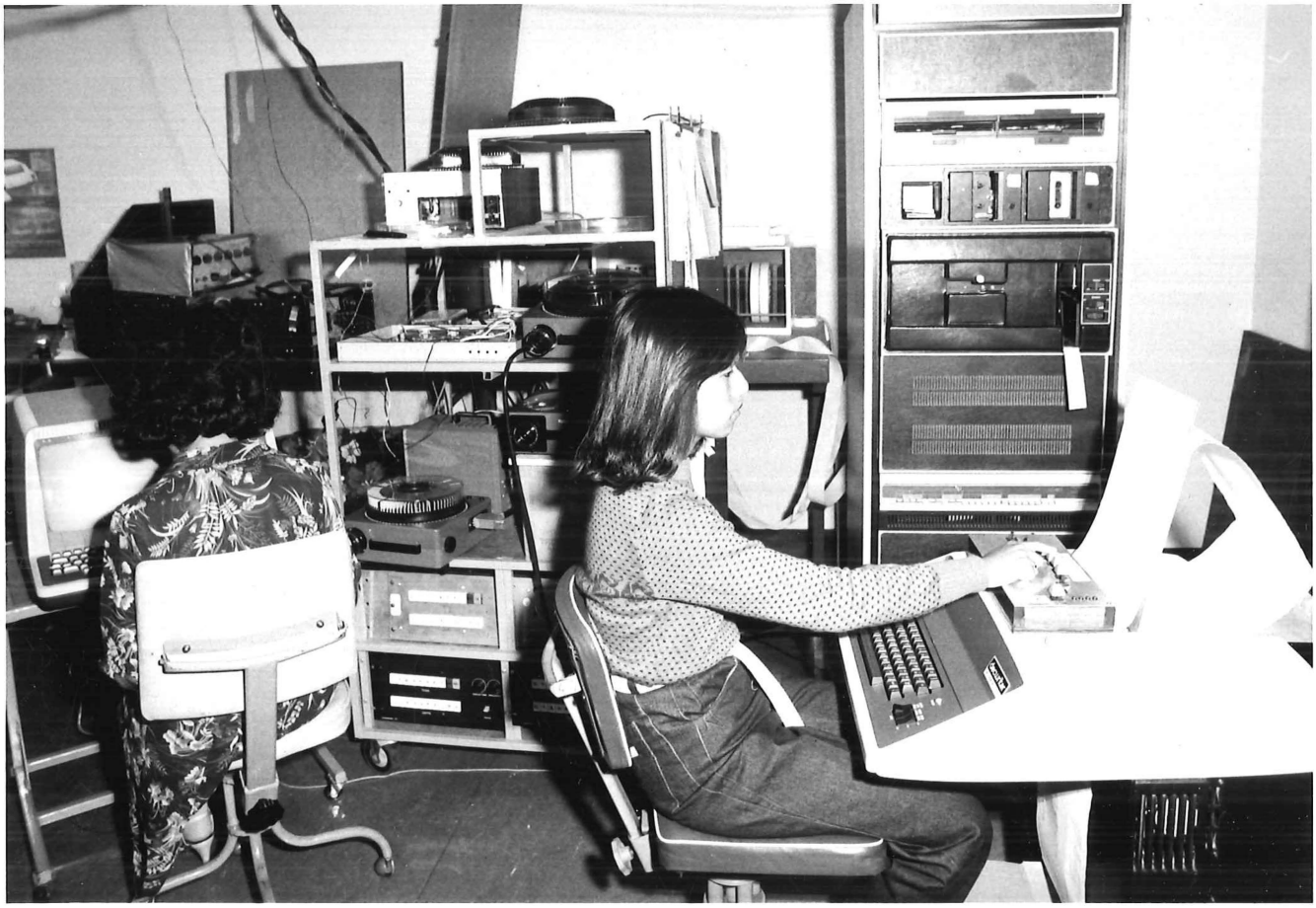
Study phase:

1. 肺	6. old	11. 羊	16. small
2. look	7. garlic	12. 輕	17. 嚐
3. ginger	8. 嗅	13. elephant	18. 鼠
4. 高	9. brain	14. heart	19. listen
5. pig	10. 肝	15. 瓜	20. 豆

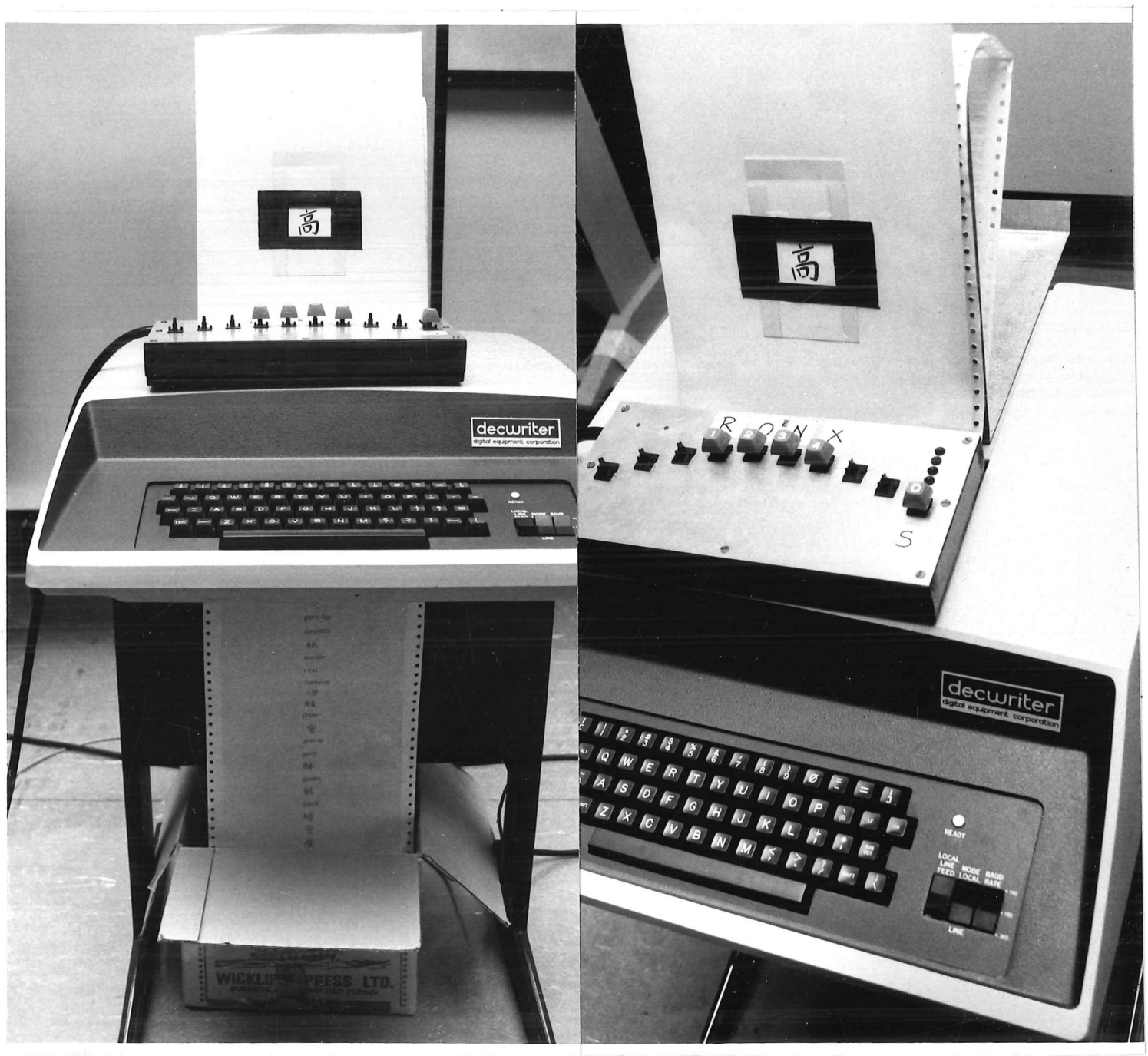
Test phase:

1. 高	11. 矮	21. ginger	31. heavy
2. dog	12. meet	22. 豬	32. garlic
3. 怕	13. 肺	23. 兔	33. 鼠
4. 老	14. onion	24. rat	34. 嚐
5. liver	15. small	25. 瓜	35. brain
6. 芽	16. old	26. 羊	36. 嗅
7. bean	17. 豆	27. 聽	37. pig
8. kidney	18. light	28. look	38. listen
9. 心	19. elephant	29. 輕	39. 胃
10. 薑	20. 肝	30. heart	40. smell

APPENDIX D



Experimental Setting



Presentation of Stimuli

APPENDIX E

COMPUTER PROGRAMS

```
LIST

LISTER  12-FEB-82  BASIC/CAPS  V01-01

 5 PRINT "INPUT NO. OF BLOCKS SAVED ON THIS FILE" \ INPUT N1
 6 PRINT "INPUT FILE NAME" \ INPUT V$
 10 OPEN V$ FOR INPUT AS FILE #1
 20 INPUT #1,N$
 30 INPUT #1,A$
 40 INPUT #1,X$
 50 PRINT "SUBJECT'S NAME, AGE AND NUMBER"
 55 PRINT N$,A$,X$
 56 INPUT #1,X1
 57 PRINT X1
 60 FOR N=1 TO N1
 70 INPUT #1,L$
 80 INPUT #1,Z
 100 PRINT L$,Z
 120 INPUT #1,T$
 125 PRINT T$
 130 PRINT "TRIAL","KEY NO.","RESPONSE TIME"
 135 FOR K=1 TO 20
 140 INPUT #1,K
 150 INPUT #1,I
 160 INPUT #1,T
 170 PRINT K,I,T
 180 NEXT K
 200 INPUT #1,R$
 220 PRINT R$
 230 PRINT "TRIAL","KEY NO.","RESPONSE TIME"
 240 FOR K=1 TO 40
 250 INPUT #1,K
 260 INPUT #1,I
 270 INPUT #1,T
 280 PRINT K,I,T
 290 NEXT K
 300 NEXT N

READY
```

```
LIST

EUNICE  12-FEB-82  BASIC/CAPS  V01-01

10 DIM I(20),T(20)
11 DIM I1(41),T1(41)
19 PRINT "INPUT NO. OF TRIALS IN THIS RUN..."
20 INPUT N1
50 PRINT "INPUT SUBJECT'S NAME, AGE, NUMBER"
55 INPUT N$,A$,X$
100 C$="ITEM "
101 D$="LIST "
110 B$=CHR$(10)&CHR$(13)
200 REM - SET UP OUTPUT DEVICE
221 Q$=CHR$(34)
226 PRINT "INPUT DEVICE AND FILE-NAME FOR SAVING DATA" \ INPUT F$
230 OPEN F$ FOR OUTPUT AS FILE #1
250 PRINT #1,N$
251 PRINT #1,A$
252 PRINT #1,X$
260 PRINT "INPUT FIRST LIST PRESENTED IN THIS RUN"
261 INPUT X1
262 PRINT #1,X1
303 REM -12 LISTS IN TOTAL; EACH LIST AS A STUDY PHASE AND A TEST PHASE
302 FOR N=1 TO N1
304 PRINT "INPUT 1 TO START NEXT LIST" \ INPUT A7
305 IF A7=1 THEN 310
306 GO TO 304
310 PRINT #1,"LIST"
312 N2=X1-1+N
313 IF N2>12 THEN N2=N2-12
318 PRINT #1,N2
319 PRINT D$&STR$(N2)
320 REM - THENTY ITEMS IN THE STUDY PHASE; 40 IN THE TEST PHASE.
330 INP(B$,0) \ INP(B$,0) \ INP(B$,0) \ INP(B$,0) \ INP(B$,0)
331 INP(B$,0) \ INP(B$,0) \ INP(B$,0)
340 REM - ADVANCE THE LIST BY ONE ITEM
345 RESP(I)
346 IF I=10 THEN 349
349 IF I<10 THEN 345
350 REM - PRESENT NEXT ITEM ON LIST
351 PRINT "STUDY PHASE STARTING NOW....  "
352 FOR K=1 TO 20
353 A$=C$&STR$(K)
356 PRINT A$
357 INP(B$,0) \ INP(B$,0) \ INP(B$,0)
358 INP(B$,0)
360 SCLK
370 RESP(I)
380 IF I=0 THEN 370
400 RCLK(T)
410 I=I-3
420 I(K)=I
430 T(K)=T
450 NEXT K
500 INP(B$,0) \ INP(B$,0) \ INP(B$,0)
510 FOR K=1 TO 500 \ NEXT K
550 REM - PRESENT TEST PHASE
555 PRINT "TEST PHASE STARTING NOW....  "
560 M$=CHR$(7)
562 REM - BELL AND BUZZER INC. LTD
563 INP(B$,0) \ PRINT M$
565 INP(B$,0) \ INP(B$,0) \ INP(B$,0) \ INP(B$,0)
566 INP(B$,0) \ INP(B$,0) \ INP(B$,0) \ INP(B$,0)
567 RESP(I)
568 IF I=10 THEN 570
569 IF I<10 THEN 567
570 FOR K=1 TO 40
574 A$=C$&STR$(K)
575 PRINT A$
576 INP(B$,0) \ INP(B$,0) \ INP(B$,0)
578 INP(B$,0)
580 SCLK
590 RESP(I)
600 IF I=0 THEN 590
601 IF I=5 THEN 620
602 IF I=6 THEN 620
603 IF I=7 THEN 620
604 GO TO 590
620 RCLK(T)
630 I=I-3
650 I1(K)=I
660 T1(K)=T
670 NEXT K
672 INP(B$,0) \ INP(B$,0) \ INP(B$,0) \ INP(B$,0)
675 PRINT #1,"STUDY PHASE"
710 FOR K=1 TO 20
720 PRINT #1,K
730 PRINT #1,I(K)
740 PRINT #1,T(K)
745 NEXT K
747 PRINT #1,"TEST PHASE"
750 FOR K=1 TO 40
760 PRINT #1,K
770 PRINT #1,I1(K)
780 PRINT #1,T1(K)
790 NEXT K
850 NEXT N
900 CLOSE #1
1000 END

READY
```

APPENDIX F

EXPERIMENTAL INSTRUCTION IN ENGLISH

ENUNCIATION CONDITION

You will be given a list of words, presented one at a time. When you are ready to start the experiment, press the key at the extreme right, labelled "S". A word will be presented. Enunciate the word as quickly and as accurately as you can. While enunciating the word, press the key labelled "R", the 'response' key. The next word will be presented and again you are required to enunciate the new word and press the key. When you reach the end of the list, a buzzer will be sounded.

In the next procedure, you will be given a list of words as before. Again, you enunciate the word as soon as you see it and press a key. This time, you use one of the other two keys. If the word has appeared previously, press the key labelled "O", the 'old word' key. If you have not seen the word before, press the "N" key, the 'new word' key.

You will be given a short list of words for practice, before you start the actual experiment.

Before you start any pair of Lists, the experimenter will tell you what to expect from the lists.

TRANSLATION CONDITION

A list of words will be presented to you, one at a time. You are required to orally translate the word that is presented. Translate as quickly and as accurately as you can. While you are giving the translation equivalent of the word, press the "R" key, the 'response' key. The next word will be presented to you and again you are to give the translation equivalent orally and press the "R" key. At the end of the list, a buzzer will sound.

For the next procedure, your task is still to translate the presented word orally. However, the key you are required to press is one of the other 2 keys. When a word you have seen previously is presented, you press the key labelled "O", the 'old word' key while producing the translation equivalent orally. When you have not seen the word before, press the "N" key, the 'new word' key while translating orally.

Before the actual experiment, you will be given a short list of words to practise. The experimenter will tell you what to expect from any pair of lists before you proceed with them.

When you are ready to start, press "S", the 'start' key and the presentation of the whole list of words will proceed one by one.

EXPERIMENTAL INSTRUCTION IN CHINESE

朗讀的條件：一

你會被給予一副字彙，一次一個地出現給你看。當你已預備妥開始試驗時，按下在最右的"S"鈕。一個字彙會出現出來，你就儘可能快速及準確地把它讀出來。同時按下"R"鈕：就是"反應"鈕。另一個字彙接着出現，你再次把它口讀出來，並按下"R"鈕。在該段字彙將結束時，响鈴會响着。

下一個步驟就是仍然一樣地，一行的字彙會出現給你看。你同樣地，儘快地把該字彙讀出來，並按下一個鈴。這次你是按其他兩個鈕之一按。如果這個字彙已經出現過的，就按着"O"鈴：就是"舊字"鈕。若這個字彙未出現過的，就按下"N"鈕：就是"新字"鈕。

在試驗未正式開始時，你會被給予一副簡短的字彙作練習。

在你未開始任何一對之字彙副表時，試驗者會告訴你如何進行之。

翻譯的條件：

一列的字象，每次一個將會出現給你看。你須要用口頭把它翻譯出來。你須可能快及準確地把它翻譯出來。同時按下"R"鈕：就是"反應"鈕。接着另一個字象會出現給你看，你再次給予口頭翻譯，並按下"R"鈕。當該列的字象結束時，將會响鈴。

至於下一個步驟就是你仍然將出現的字象用口頭翻譯出來。但是，你祈須要按的鈕是其他兩按鈕之一。當一個字象是你已經見過出現的，你就按下"O"鈕：就是"舊字"鈕。若你沒有見過這個字象，則在給予它的口頭翻譯時，同時按下"N"鈕：就是"新字"鈕。

在試驗正式開始之前，你會先被給予一行簡短的字象作練習。試驗者會先告訴你如何進行任何一對的字象列表。

當你已預備妥開始試驗時，按下"S"鈕：就是"開始"鈕，隨着整列的字象會各別地出現給你看。